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SCIENTIFIC LIAISON

THE objectives of scientific liaison may be classified as follows:

(1) Establishment and maintenance of personal contact with the scientists and technologists of the region in question, and with the institutions—governmental, university, and industrial—in which they work. This naturally involves a considerable amount of travelling, and the liaison officers have to be prepared for the inevitable discomforts and even dangers incidental to travel in non-industrialized countries.

(2) Establishment of the liaison office as a clearing-house and information centre for the supply and distriubtion of

(*a*) scientific literature, whether in the form of original journals and papers, microfilms and their reading machines, photostats and all kinds of documentation,

(*b*) essential scientific equipment and materials, ensuring that they reach the proper recipients in the region,

(*c*) scientific information already existing on problems in the region,

(*d*) ideas and suggestions which might be obtained from the centres of science and technology in the advances countries to meet specific problems in the region.

(3) Facilitation of the outward movement of scientific and technical reports from laboratories and other sources in the region, and its scientific journals, to the main centres of science and technology.
(4) Help in informing the outside world of interesting and important work being carried out in the region.
(5) Arrangements for the exchange of scientific correspondence and manuscripts, scientific papers, articles and reviews for publication.
(6) Provision of scientific advice, when required, to governments of the region; and co-operation with bilateral scientific missions, scientific attachés and government service scientists who may be working in the region.
(7) Facilitation of visits, which may be of short duration, by eminent scientists to the region, and encouragement of all plans for international collaboration in research and co-operative expeditions.
(8) Co-operation with, and when necessary, advice to, the other Specialized Agencies of UN.
(9) Assistance to all schemes of personnel exchange across the boundaries of the region.

One might summarize by describing the primary function of Unesco's Field Science Co-operation Offices as one of "facilitation" including the collection, exchange and dissemination of scientific information in a two-way flow, between each particular region and the rest of the world.

How do the liaison officers carry out their work?

Technical advice is given immediately wherever possible, but when this is not possible, they either write to specialists outside their area for the information required, or pass on the question to the Headquarters Unit at Unesco House, Paris, where the staff endeavour to obtain replies, either by consulting the other members of the scientific secretariat, or by further recourse to outside authorities. Besides the Headquarters Unit of the Field Sciences Co-operaion Offices, Unesco's scientific secretariat includes specialists in Pure, Medical, Agricultural and Engineering Sciences, Scientific Documentation and Apparatus, and the Social Implications of Science and History of Science. At Unesco House, again, the Libraries Division has a wealth of information on book and periodical exchanges between libraries; the Exchange of Persons Department constitues the world clearing-house for all internationally available fellowships and studentships; and there are the Departments of Education and Culture. Through the Unesco Office in New York, microfilms and other forms of documentation, or special samples of chemicals produced in U.S.A. may be obtained. The Headquarters Unit has access to the library of the French *Centre National de la Recherche Scientifique* for reference, and may obtain bibliographies from the *Commission Internationale des Industries Agricoles* Last but not least, Headquarters Unit can appeal to the secretaries of the various International Scientific Unions, of which mention has already been made, who are in a position to give the most authoritative information on the present state of any particular question, or who can indicate what specialist in what country should be applied to for the information needed.

The various Field Offices maintain contact with one another. This is worth while emphasizing, since, side by side with Unesco's network, the offices of the cultural relations organizations in various countries still provide a most important means of conveying scientific information to enquirers. Thus, during the war, it was the experience of members of the Sino-British Science Co-operation Office that if a Chinese scientist requested some information about scientific work going on in England, it was relatively easy to obtain it for him without delay, but if he made a similar request for the information about Swedish or Venezuelan work, the matter was not so simple, as no regular machinery existed for getting it. This multilateral service is exactly what Unesco's Field Offices are able to provide.

(By courtesy of UNESCO publications)

MEDICAL BOOKS IN TIPPOO SULTAN'S LIBRARY*

D. V. S. REDDY

(Professor of Physiology, Madras Medical College)

IN the course of my search for old medical books, especially those written by medical men who served in India on the common diseases and treatments prevailing in the country, in the 18th and 19th centuries I fortunately encountered upon a veritable vein of gold in Mysore when I came across a list of books in the library of the Tippoo Sultan of Mysore, distinguished for his enlightened patronage of learning and reputed for his deep and extensive scholarship. He was a great lover of books and owned a magnificent collection of very valuable and rare volumes.

After the fall of Tippoo Sultan and the capture of Srirangapatnam in 1859, the British displayed commendable foresight and devotion to science in their decision to preserve the library of Tippoo Sultan. A few manuscripts were selected for presentation to the Asiatic Society, Universities of Cambridge and Oxford and the East India Company. The major portion of the library, however, was transferred to Calcutta, for the instruction of the Company's employees in the Sciences of Europe and Asiatic languages.

A descriptive catalogue of this collection, "The Oriental Library of Tippoo Sultan" was prepared by Charles Stewart, Professor of Oriental Languages at Hertford College, and printed at the Cambridge University Press in 1809.

According to this author, the library of Tippoo Sultan consisted of nearly 2,000 volumes in Arabic, Persian and Hindustani. Many of the manuscripts were beautifully written and artistically bound, but a great many had unfortunately lost the first and the last pages, making it extremely difficult to discover the author or the period in which they were composed. One would like to know whether there were similar books and manuscripts in the European languages and if so, where they are today.

Professor Stewart writes that they were part of the acquisitions by Tippoo's illustrious father. "Some of them had formerly belonged to the Mohammadan Kings of Bijapur and Golconda. But the greater number had been the property of Nawab Nasir Addowlah Abd el Vahib Khan, brother of Mohammad Ali of Carnatic and were taken by Hyder in the Fort of Chittor during 1780."

The Arabic books, forming less than a quarter, consist of the standard works of Al Razes, Avicenna, etc. The descriptive catalogue of Oriental books contains 2 lists of medical books (68 in all): (1) The section entitled "Physic books, Persian"; (2) "Arabic Books". Nearly three-fourths of the books are in Persian. They are the more important, as some of them belong to the early part of the 12th and the 13th centuries, and emanated from the great centres of culture such as Khuarizm, Jorjanny, Khorassan, Bokkhara, Shiraz, etc.

Besides many old and authoritative works on Medicine copied from Persia and Turkestan, there are also some treatises which the Persian and Turkish Physicians wrote in India, under the patrenage of the Indian Rulers. No.4 in the section of Persain Medical treatises, is a book on "Gynecology and Pediatrics", written by Mansur Mahommad, and dedicated to Sikander Shah II, of 'Dhely'—round about 1300 A.D.

No. 9 is called "Mine of Remedies", written by Bava Bhauz Khan. The date is given as 1512, and the book is said to be dedicated to Sikander Shah of Dhely. (The book itself must be re-examined to check these points.)

No. 18 is *Tibbi Akbari* (translation of the Arabic work); No. 19, *Tyurribati Akbari* is a work on physic and personal hygiene; No. 20, *Corababini Cadarv*, contains the Pharmacopæia of Hindustan. All the three books (Nos. 18, 19, 20) were composed by Mohammad Akbar Arziny, Physician to Emperor Aurangazeb, to whom they are dedicated.

No. 21 is a treatise on Medicine, Food and Clothes, by Mohammad Riza and dedicated to Emperor Aurangazeb.

Next, we may mention a few books, important for the history of Medicine in Madras. No. 24 is a treatise on Diseases, composed in 1747; No. 25 is an appendix to the above; No. 26 is a treatise, giving the

* In commemoration of the 150th Anniversary of the great Tippoo Sultan of Mysore.

Pharmocopæia of Medicines used in Carnatic and complied in 1751 A.D. The author of these three books was Sekunder Ben Ismail of Constantinople, Physician to the Nawab Mohammad Aly Khan of Arcot, to whom the books are dedicated.

Lastly, books written under the direction of Tippoo Sultan himself are very interesting and instructive (Cat. page 113). These are important for the history of Medicine in Mysore. Some of them are in the traditional or orthodox style.

No. 42, *Bihral Munafi* (The Sea of Profit) is a treatise on midwifery, treatment of children, enchantments, exorcisms of devils, etc., by Mulud Mohammad, dedicated to Tippoo Sultan (1794 A.D.).

No. 43 is a general treatise on Medicine, alphabetically arranged, composed by Mohammad Nasir Afshrar Turk and dedicated to Tippoo Sultan.

Other volumes illustrate the new trends and influences. Besides, they clearly establish the fact that contrary to the prejudiced reports of European historians, Tippoo was very progressive in his outlook and views, and encouraged the study of the European literature on Medicine, trickling in slowly through the trader, the diplomat and the doctor. Knowledge and particularly Medical Science, was liberally patronised and actively encouraged by him, irrespective of its source or country; the knowledge itself was freely incorporated and utilised for the benefit of the people. This laudable spirit of Tippoo Sultan is amply borne out by the following works:

No. 44. *Kanun Der Ilmi Tibb.* A translation of the complete London Dispensatory: The date and the name of the translator are not given. The translator says in his preface that this work is the result of the united efforts of all the learned (physicians) of Europe and translated by the Order of Tippoo Sultan;

No. 45. *Terjumeh Ketabi Angriz.* (Translation of the English treatise on Electrical and Medical Experiments);

No. 46. *Turjumah Ketabi Freng.* (Translation of Dr. Cochrane's treatise on "Twist of the Intestines".)

In addition to these books in the section on Physic, there is, in the section on Arts and Sciences, a book, No. 9 (page 97 of the Cat.) called "A Treatise on Botany and Natural History" translated by the Order of Tippoo Sultan from French and English books. It has good etchings of plants.

The Unknown Authors.—In a footnote (p. 97) Professor Stewart says, "It appears that Tippoo Sultan was an encourager and patron of the Arts and it is stated that 45 books on different sciences were either compiled or translated from different languages under his immediate inspection or auspices. It is probable that some of our unfortunate countrymen, who were so long detained in captivity and had thereby acquired a knowledge of the Dekkani languages assisted him in these persuits". It is also possible that there were some Europeans in his employ as personal physicians and surgeons, who were encouraged to do literary work under the patronage of the Sultan.

A SOUTH SEAS OBSERVATORY

THE Bosscha Sterrewacht Observatory at Lembang in Indonesia, which was seriously damaged during the war, is to receive material assistance organized by UNESCO.

American and Dutch astronomers are collaborating to ensure the consruction of a new type of astronomical telescope, consisting of two minors, one of them 3 ft. in diameter.

The Bosscha Observatory is situated in what the famous astronomer Dr. Gerard P. Kuiper of the University of Chicago Yerkey's Observatory describes as "one of the most beautiful spots on earth".

The opportunities for good research work at this observatory are great, because of its favourable location 7° south of the Equator, which makes the southern stars visible; and its adequate elevation, 4,200 ft., which ensures a good climate.

The observatory was heavily damaged during the war and the young Director and his two assistants died at the hands of the Japanese. Chicago University and Yerkey Observatory, the University of Leiden, Holland, the University of Louvain, Belgium, and Unesco are shortly to sign an agreement whereby this Far East observatory will receive help, and thus be able to play an important part in advancing astronomical knowledge. (Courtesy of *Courier*, UNESCO, 1-11-1949.)

PROTEIN HYDROLYSATES FOR THE MICRO-BIOLOGICAL ASSAY OF AMINO-ACIDS*

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THE circumstance that certain amino acids in a protein hydrolysate can be selectively and quantitatively removed or destroyed, offers the attractive possibility of employing such hydrolysates in the micro-biological assay of some amino acids. For tryptophane assay for example, Green and Black[1] have used an acid hydrolysate of casein; Lyman[2] has used H_2O_2 treated peptone for methionine assays. In the course of nutrition studies, protein hydrolysates have been widely employed from which a given essential amino acid is eliminated by suitable treatment. Wood, *et al.*[3] have used freshly prepared Raney's nickel for the removal of organic sulphur from sulphur containing amino acids from a protein hydrolysate. Ion-exchange resins have been used by Sperber,[4] and Cannan[5] for the removal of di-carboxylic and the basic amino acids. Lewis,[6] *et al.* have removed glutamic acid quantitatively from casein hydrolysate as pyrolidonecarboxylic acid.

Experimental

Acid hydrolysate of casein was prepared by the method of Snell and Wright[7] and alkali hydrolysate was prepared using barium hydroxide which is quantitatively removable as sulphate. Acid hydrolysates, after supplementing with cystine, methionine, and fortification with vitamins, purine bases, salts, sodium acetate and glucose, have been found useful for tryptophane assays. Similarly alkali hydrolysates fortified with methionine, and arginine or cystine, have been found suitable for the assay of cystine and arginine respectively.

The pre-treated hydrolysates, before actual use, were tested for their freedom from a given amino acid by chromatographing the liquid on paper using the capillary ascent test tube method developed by Rockland and Dunn[8] with *n*-butanal-acetic acid as developing solvent. What is shown to be absent by this test has been found to reach the microbiological standard of purity, as can be seen by Table I.

TABLE I

Treatment of casein	Amino acid removed	Chromatogram test	Micro-biological test
Acid hydrolysis	Tryptophane	Spot absent	Absent
Acid hydrolysis	Tryptophane	Spot absent	Absent
and H_2O_2	Methionine	Intensity of Valine-Methionine spot reduced to half	Absent
Alkali hydrolysis	Cystine arginine	Intensity and diameter of basic amino acid spot is less than control	Both absent

Media for the assay of tryptophane, methionine, cystine and arginine:—

	Tryptophane	Methionine	Arginine	Cystine
Basal medium 15 ml. each (composed of all vitamins, purine bases, salts and sugar) ..	+	+	+	+
Acid hydrolysate of casein ..	+	−	−	−
Alkali hydrolysate of casein ..	−	−	+	+
H_2O_2 treated acid hydrolysate of casein ..	−	+	−	−
Tryptophane ..	−	+	−	−
Methionine ..	+	−	+	+
Arginine ..	−	−	−	+
Cystine ..	+	+	+	−

Volume was made up to 50 ml. in each case, and the pH of the media adjusted to 7·2.

1·5 ml. of the double concentration medium was transferred to 4 ml. capacity pyrex tubes (4" × ½") and graded doses of tryptophane, methionine, cystine or arginine as the case may be were added and the volume in each tube made up to 3 ml. by adding the requisite quantity of distilled water. The tubes were steam sterilised for half an hour, cooled and inoculated with the thrice washed saline suspension of the test organisms. After 72 hours of

* Presented at the Symposium on 'Microbiological Assay of Amino Acids, Vitamins and Other Growth Factors' held on 17th December 1949 at the Indian Institute of Science, Bangalore, under the auspices of the National Collection of Type Cultures, India, and the Society of Fermentation Technologists, India.

incubation at 37° C. the entire quantity was titrated against N/20 NaOH. The results are graphically illustrated.

Amino acid	Organism	Range	Remarks
Tryptophane	*L. arabinosus*, NCTC 2161	0·0–2·0γ	Ideal
Methionine	*Leuconostoc mesenteroides* P-60 NCTC 2177	0·0–15·0γ	Ideal
Arginine	S-190, NCTC 2185	0·0–50·0γ	Ideal
Cystine	*L. Casei* e, NCTC 2153	0·0–20·0γ	Ideal

Discussion

The pre-treated hydrolysate provides a simple, inexpensive and well-balanced mixture which can safely replace the usual medium compounded from individual

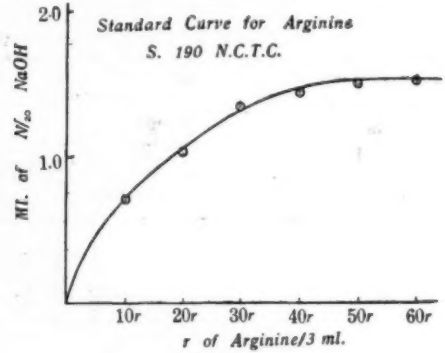

FIG. 1

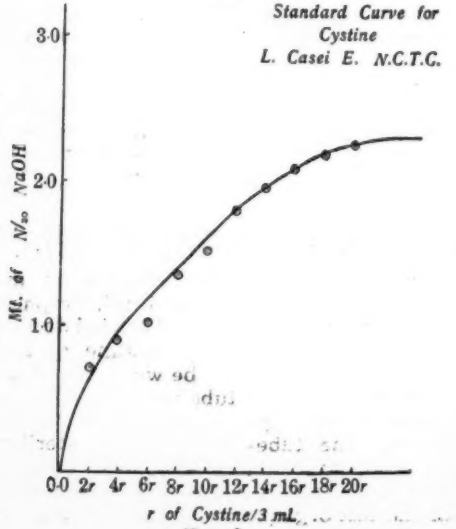

FIG. 2

amino acids. The use of expensive amino-acids which are now difficult to import can be mininised for most of the assays. These pretreated casein hydrolysates have been utilised for obtaining the standard curves for arginine, cystine, methionine and tryptophane (see Figs. 1-4) and are now

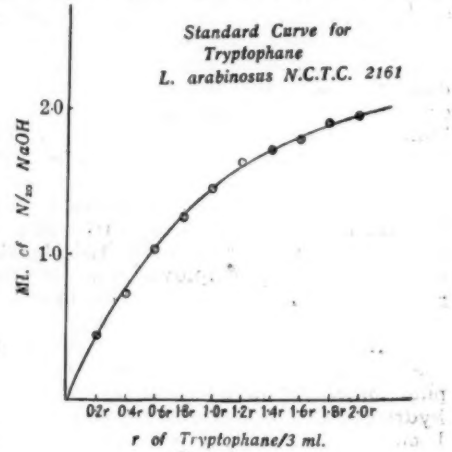

FIG. 3

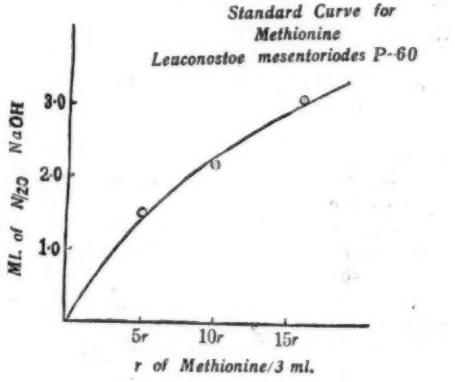

FIG. 4

being extensively employed in our laboratories for the routine assay of these amino acids in biological materials.

Our grateful thanks are due to Dr. N. N. De, for certain facilities extended to us and to the Council of Scientific and Industrial Research for their generous financial support.

1. Green, R. and Black, A., *Jour. Biol. Chem.*, 1944, **155**, 1. 2. Lyman, C., *et al.*, *Arch. Biochem.*, 1946, **10**, 427. 3. Wood, John L., *et al.*, *Federation Proceedings*, 1949, Part I, 266. 4. Sperber, E., *Jour. Biol. Chem.*, 1946, **166**, 75-78. 5. Cannen, R. K., *Ibid.*, 1944, **152**, 401. 6. Lewis, J. C., and Olcott, H. S., *Ibid.*, 1945, **157**, 265. 7. Snell, and Wright, *Ibid.*, 1941, **139**, 675. 8. Rockland, B., and Dunn, M. S., *Science*, 1948, **108**, 213.

SPECIAL LIBRARY SERVICE

ALTHOUGH, by definition, a special library is a special collection of books serving a special clientéle and using special methods for the purpose, it may assume an importance not less than that of general libraries which in size may be much bigger.

In recognition of its importance, the Indian Library Conference, at its session held in 1946 at Baroda, passed a resolution favouring the establishment of a special libraries section as an indispensable wing of the Indian Library Association, with a view to meet the increasing demand on the libraries in India, following the move for the rapid industrialisation of the country.

It is gratifying to record that a special library service has already been started at the Library of the Indian Institute of Science, Bangalore, which has been building up special sub-libraries devoted to particular subjects like Aeronautics, Metallurgy, Internal Combustion Engineering, High Voltage Engineering, Chemical Engineering, the Social Sciences, and Economics. The sub-library being the nucleus round which the special library has to evolve, there is every reason to hope that before long there will be special libraries relating to all important subjects in pure and applied sciences, at this centre.

It is a hopeful sign that the Indian Library Association has already appointed an *ad hoc* committee to go into the question of special libraries. Most of the members in question are themselves in charge of libraries devoted to specialised fields such as agriculture, irrigation, science and technology. An annotated guide-list of special libraries in this country was first published in the Oct.-Dec. 1941 issue of the *Modern Librarian*. It shows that there are already in this country libraries attached to special fields such as public health and hygiene, chemical technology, industries, railways, forestry, geology, medicine, serology, dairying, veterinary sciences, architecture, commerce, meteorology, statistics, banking, botany, zoology, tropical medicine, indology and Indian culture. Libraries devoted to textiles and food technology have recently been started at Ahmedabad and Mysore. More libraries are coming into existence at all research centres like Poona, Bombay, Calcutta, Jamshedpur, Dhanbad, Delhi, Madras, Roorkee and Karaikudi. Besides these there are at least three information bureaux functioning now at Kanpur, Delhi and Bangalore, while there are indications that more will be started in the near future.

With these developments coming into being, more librarians with experience in special and technical fields will be called upon to organise and man them. Naturally, this brings to the foreground the question of special library training, which is indispensable, and which can be most profitably achieved by the system of taking in scientifically qualified students for library training, and then as apprentices in special libraries for a period of intensive training in special fields under expert guidance.

In conclusion we may observe that while a beginning has been made to realise the importance of special libraries, needed for the industrial and scientific advancement of our country, there are problems connected with it which can only be solved if they are tackled with a sense of urgency by an organisation exclusively devoted to the promotion of the special library movement in India.

G. T. KALE.

TRIALS, DUTIES AND REWARDS

STANDING on the threshold of a new era, India faces today great trials, great duties and great rewards. The precious gains towards which we may hope to progress is in the development of our industries, agriculture, scientific research, transport, defence, public health, education and other creative endeavours, which contribute to the strength and well-being of the country. In the trials and in the duties essential to that progress, we the scientists and technologists of the country, in our infinitely varied types, have to play our rightful part and bear our full share. Indeed, ours is a responsibility unequalled by that of any other section of the people. To enable us to discharge this responsibility, it behoves the State to create the necessary conditions in the coming years.

—SIR S. S. BHATNAGAR.

SCIENCE AND THEOSOPHY*

THE four volumes under the suggestive and comprehensive title "Where Theosophy and Science Meet" edited by D. D. Kanga had been noticed from time to time in the columns of the *Current Science*, and the volume under notice that has been published as No. 21 of the Adyar Library Series constitutes a revised, reset, and enlarged edition of the previous volumes of which *two* are here presented, the other two being reserved for a second volume. Part the first under the title "Nature" describes or traces the movement from "Macrocosm to Microcosm", and the second part entitled "Man" sketches the progress from "Atom to Man". Within the limits of a critical review, it is neither possible nor desirable to undertake any detailed examination of the doctrines and theories expressed in the volume, and the facts and data on which these peradventure rest, that *do not* and *would not* admit of any laboratory testing under controlled conditions through the instrumentality of qualitative and quantitative analysis. Let me, therefore, direct my attention to the general lead given in the "Introduction" to the revised edition.

There is the inevitable reference to chaos and conflicts in the world and to the Atomic weapons of destruction. What is the diagnosis? All the troubles are due to "fundamental maladjustments which are due to lack of perception of the essential values of life". The author illustrates the maladjustment by reference to a correlation effected between *Body* of Man and Economics and Politics, *Mind* of Man and Science and Engineering, and the *Spirit* of Man and Ethics and Spirituality. Further elaborating the nature and characteristics of such a maladjustment, he points out that while the sciences and disciplines correlatad with Body and Mind seem to be moving pretty fast, those connected with the Spirit move slowly with snail-pace.

What is the remedy or the prophylactic? It is suggested that World-order, Social-order, Governments *et hoc* should be reconditioned and readjusted on the basis of absolute primacy and pre-eminence assigned to Ethics and Spirituality correlated with the *Spirit*. *Mind* and its correlates would rank next. At the lowest rung of the ladder of the New Civilization would stand *Body* with its correlates of economics and politics. The New Order must be built on the bed-rock of "right triune concept of man".

It has become an alarmingly infectious fashion nowadays for intellectuals dithyrambically to complain of maladjustments brought about by modern civilization and conditions of living grounded on the discoveries and inventions made possible by the advancement and progress of different positive laboratory sciences, but, whether a phenomenon like the World-Armageddon I or II is to be regarded as an adjustment or a maladjustment must depend in the last and final analysis on the definition of adjustment and maladjustment one may arrive at or formulate. When the reign of relativity is supreme, it will be always possible to argue that what is termed maladjustment from one stand-point may be really adjustment from another. The analogy pressed into service in the Gita must be of striking help. What the common folk including our best economists and politicians and so-called world-figures and personalities, leaders of world-thought and energisers of world-action regard as waking life and broad *daylight*, is really *night* to a genuine seer or saint. Likewise when the genuine seer or saint enjoys daylight, the common folk are in deep sleep immersed in cymmrian darkness (*Yanisa-sarvabhootanam*...., Gita, 2-69). What the Lord wills on a cosmic scale cannot be a maladjustment in biological or sociological connotation. This apart, is the author's diagnosis correct? Is the prophylactic proposed effective?

As far as I can see, the diagnosis to the effect that modern civilization grounded on science and scientific values stands maladjusted on account of its failure to have regulated life in the light of Ethics and Spirituality does *not* seem to be correct. For, one cannot convert mankind overnight into saints and spiritualists. Even in the maladjusted age, Ethics and Spirituality are bound to appeal to a small, microscopic minority. Such an appeal has elicited responses and aspirants patterned that way are even to-day leading higher life the details of which would never get into newspaper columns. When there is no demand, there is no supply. This rule of economics would apply to the economics of higher life as well. Throughout the world, the demand for Ethics and Spirituality is scanty, and you can-

* *Where Theosophy and Science Meet*. Vol. I. Edited by D. D. Kanga, I.E.S. (Retd.), The Adyar Library Association. Adyar, Madras. Pp. liv × 418. Price Rs. 9.

not describe that as a maladjustment. If, with eyes wide open, individuals, communities and nations mould their conduct on the motto "Evil! Be Thou My Good", urged on by the potential of their past *Karma*, such behaviorism or meta-behaviorism as American Psychologists would have it cannot be described as maladjustment.

If, as I feel, the diagnosis is incorrect, the remedy, I am afraid may not be effective. (I had almost typed quack-remedy—as suggested by Leonard Wolfe's "Quack-Quack".) It is so easy to talk of Ethics and Spirituality. All the world-teachers have done that. Notwithstanding the appearance on the world-stage of Christ, Buddha, Krishna, and others, and the prevalence of their teachings and doctrines, you hear the loudest of complaints that science and science-built civilization have hurled the world into the abyss of maladjustment. What Srijut Kanga and other good, and well-intentioned souls miss is the solid and stubborn *fact* that Ethics and Spirituality cannot be patented into powders and pills and administered to war-mongers and world-monopolists and cosmic capitalists. They are all urged by their *self* conditioned by *Prakriti* (*Prakritim-yantibhootani...*, Gita, 3-33). Patented peace-pills now sought to be sold by the UNO, UNESCO and other world-organizations may find salesmen and saleswomen, but, they would have little or no effect on the patients themselves.

I hasten to submit that I have no desire either to belittle or underrate the value and significance of the magnificent work in the direction of humanization and spiritualization of mankind that is being attempted by Srijut Kanga and others who have collaborated and co-operated with him. Nevertheless, in the interests of impartial and disinterested research and investigation it must be pointed out that a mere academic call to ethicize and spiritualize behaviorism will never be competent or sufficient to save mankind.

With many other *dicta* or *obiter dicta* of the author of the "General Introduction" it is impossible to agree. For instance, it is said that "The present is a mind-dominated world". It is *not*. It is throughout dominated by mind, body, and spirit, *tria juncta in uno*. Those who are at the helm of national and international affairs to-day are guided and dominated by a particular pattern of mind, body and spirit. You may discern direst disaster in the pursuit of the pattern. Whatever the condition in Western Psychology, in Indian Psychology intellect, emotion and will, the cognitive, the emotive, and the conative are *never* separated from one another. A "pure" and "unconditioned mind" is of no use in solving the problems of war and peace, because, when *unconditioned*, as in strict Vedantic connotation, the mind becomes or gets centred on eternal verities that bear no relation to the myriad-faced and hideous hedonisms of economics and politics.

It is neither here nor there. The problem posed by Sankara, to mention but a single classic instance, is still awaiting solution. In describing the affairs and concerns of the world, Sankara has used *two* key-terms. They are "Anartha" and "Prahana". The world and its affairs (Lokavyavahara) are *not* yet evaluated as demanded by the Acharya. They involve, one in colossal disaster. The root-cause of that disaster must be eradicated. The indispensable preliminary to all spiritual outlook is the sharp and poignant perception that the values of the world, economic, political, etc., must be superseded and transcended (Prasankhyana, as Vachaspathi Misra puts it with unerring and downright effect).

Does Theosophy counsel such a course? Perhaps it does. If so, I can categorically assert there is *no need* for Theosophy to meet Science at all. There is a section in the volume on "Scientific corroborations of Theosophy". I would like to question—who is so anxious to get such corroboration? For whose benefit do Science and Theosophy meet? Is it for the benefit of modern Science? Arrogant and supercilious modern Science that has been responsible for the Atom-Bomb is *not* anxious as far as I can see, or as far as collective judgment of the Scientists itself would indicate. Or, is it for the benefit of Theosophy? A Theosophy that stands in need of corroboration from laboratory sciences that are *per se* incompetent to deal with such subject-matter as God, Transmigration, Karma, and so forth has to be pronounced nervous and lacking in self-confidence. They may after all meet as the *Prakriti* and *Purusha* of the Sankhya system are reported to have met. But, nothing would come out of the meeting that must eternally remain *barren*.

I carefully note what is said about the "True Democratic Way of Life", but, the expression is as good or as bad as *Rama-Rajya* about which so much noise is being made just now. With India (Bharatavarsha) politically and territorially cut or dichotomized into *two*, with ubiquitous, obnoxious controls of all necessaries of life, with ominous food and cloth scarcity, with communistic and communalistic

troubles here, there, and everywhere, if under the urge of political sentimentalism, one were to claim that we are now living in *Rama-Rajya*, such a person must be dismissed as *non compos mentis*. The so-called True Democratic Way of Life seems to me to be neither True, nor Democratic, nor even a way of life, because, behind a facile and ringing terminology, no Reality is discernible. Paradoxically enough, one can talk of a True Democratic Life only when the values of life including political democracy and self-government, which certainly is *no* substitute for good government, are subjected to rigorous transvaluation on the criterion pointed out by Sankara and the great Acharyas. I am feeling guilty of having exceeded the space-limit set by the learned and talented Editor of *Current Science*. I shall conclude the notice with only one more observation.

Great stress is laid on what is called the "Occult Method," the "Occult Science" and so forth including "Occult Chemistry". The occult method may not differ from the elaborate and complicated methodology developed by Patanjali's Yoga-Darsana. Here again, it is impossible to hide or forget the fact that the occult method has *not* been used by any to relieve global distress and unrest. This is claimed to be supplementary to the scientific method and also superior to it. Its superiority is yet to be demonstrated under controlled conditions. Neither the methodology of Yoga nor the occult method can be universalised for global consumption on a mass-scale.

Prof. Kanga and the monographists that figure in the volume must have the heartiest felicitations of the thinking section of humanity. The volume is stimulating and challenging. Prof. Kanga's narration of the story of the Atomic Bomb is really romantic and thrilling. When all is said and done, *Theosophy* should grow more and more *theosophical*. *Science* should grow more and more *scientific*. Neither should coquette with the other. The result of such coquetting would be final meeting in the Divorce Court on the supremest ground of temperamental incompatibilities. The Atomic Bomb is *not* a challenge to Man. It is a challenge from a man of *some knowledge* to another who is *ignorant* of the Uranium-transaction. A distracted author from America asks—Can Psychology save modern Civilization ? (*New Froniers of Psychology*—Nicholas deVore—Philosophical Library—New York). Readers are bound to ask—Can Theosophy and the Occult method save mankind and its civilization ? For answer please see page 214 of the volume. P. 204 contains a misprint (Sanskrit text).

R. NAGA RAJA SARMA.

BUILDING RESEARCH IN INDIA

A BUILDING RESEARCH UNIT was set up at Roorkee in 1947 to deal with problems such as construction of low-cost houses and utilisation of cheap construction materials. It is proposed to extend the activities of this unit and establish a Central Building Research Institute at Roorkee.

When the Institute starts working in full swing, the major Divisions would be further divided into sections to deal with subjects such as : (1) Studies on Puzzolanic Material, (ii) Preservation of Stones, (iii) Studies on Paints and Varnishes in relation to Building Materials, (iv) Ceramics and Heavy Clay Products in relation to Building Requirements (v) Studies on Soils, (vi) Studies on Corrosion of Metals used in the Building Industry, (vii) Studies on Fire Resistance Properties of Building Materials, (viii) Structural Acoustics, (ix) Physiological Studies on Inhabitants in Tropical Climate (x) Studies on Foundation Problems, etc.

There will also be an Intelligence Section in the Institute whose functions would be (i) collection of available information on the subject (ii) translation and co-relation (iii) dissemination.

The Central Building Research Institute will also have as one of its functions the co-ordination of all the work done on Building Research in the country besides the other functions already pointed out.

The Physico-Chemical Laboratories of the Unit are fairly well equipped. Some of the engineering testing equipment is also available and heavier testing equipment worth £1,300 has been ordered from abroad. The Library attached is well stocked with the latest volumes on important subjects, and subscribes to all topical Journals, besides posting itself with the latest technical bulletins and publications of kindred research stations in other part of the world.

MODERN SYNTHETIC RUBBERS*

THE development of Synthetic Rubber is one of the greatest achievements of chemical industry. Originally limited only to the very narrow field of rubber manufacture, synthetic rubber is now challenging, more and more, many of the domains in which natural rubber once reigned supreme. By 1948, capacity for production of synthetic rubber reached 1·2 million tons in U.S.A.

The author of the treatise under notice has discussed the question of raw material for the production of synthetic rubber at considerable length in Chapters VI and VII. Butadiene, by far the most important ingredient of a synthetic rubber molecule, is produced from alcohol by the Levedov process. The Russians obtained alcohol from potatoes and the Americans from grain; it is now obtained from ethylene which is present in the tail gases of petroleum refineries. The Germans concentrated on the use of acetylene obtained from calcium carbide as their principal raw material, and butadiene was obtained from acetylene, through aldol condensation of acetaldehyde.

The last three chapters of Part II form an interesting review of the various methods of polymerisation with particular reference to the manufacture of synthetic elastomers. But the paragraph on the mechanism of polymerisation at the end of Chapter VIII is too short. A little more information regarding the actual mechanism involved would have given it the completeness which it lacks at present.

The chapter on compounding in Part III of the book attempts to give too much information in too little space with the result that clarity suffers.

A good account is given, however, of the compounding and processing of various elastomers and of the properties of their vulcanisates in the chapters dealing with each individual elastomer. The manufacturing details of GR-S and Buna-S are also included.

Unlike natural rubber, unloaded GR-S compounds show inferior physical properties. Carbon black is absolutely essential in order to bring out the best characteristics of GR-S. The use of specially prepared furnace blacks for the reinforcement of GR-S in preference to channel black used for natural rubber opened a new chapter in the manufacture of rubber grade carbon black. Although furnace black of the type of Kosmos is most suitable for good tensile properties of GR-S, lamp black has been found to be more advantageous for applications requiring high resilience. This is not explicity stated in Chapter XIII, but a passing reference is made to the behaviour of lamp black in GR-S.

The fact that due to certain outstanding properties such as resistance to solvent action, gas permeability and fire, synthetic elastomers like Perbunan, Butyl rubber and Neoprene have come to stay in the field of rubber technology is clearly brought out.

The chemistry of synthetic rubbers is so closely related to that of plastics that sometimes it becomes difficult to say whether a product is a synthetic rubber or a plastic. Silicone is a typical example. Incidentally, it may be noted that no mention of this polymer is made by Barron in his book. Chapter XX is devoted to Polyvinyl palstics, mixtures of Perbunan and Polyvinyl chloride compounds, flex, tear and ozone resistance.

The new class of compounds 'Lactoprenes' serves as an indication that there are still possibilities of new synthetic elastomers being produced.

The last chapter where the properties of different elastomers are compared is very valuable for purposes of reference.

In the section on molecular weight of rubber (Chapter V), there is no reference to the recent work on molecular weight determinations of rubber. This is especially surprising. Also, there is no mention of 'Cold rubber' which is the latest version of GR-S, and which has been reported to compare very favourably with natural rubber.

On page 271, accelerators are defined as chemical compounds which 'hasten the rate of vulcanisation'. This reduction in time of vulcanisation is only *one* on the functions of an accelerator. The majority of accelerators profoundly influence the properties of the resulting vulcanisates. The statement in Chapter XI that in compounding the main object is 'to reduce costs without sacrificing quality' is open to question.

These are points which can be overlooked. The book is a valuable contribution to the literature on synthetic rubbers, and may be read with profit.

J. C. GHOSH.

* "Modern Synthetic Rubbers." (Chapman and Hall, 1949; pp. xix + 636. 45 *sh.*)

MICROBIOLOGICAL ASSAYS

UNDER the auspices of the National Collection of Types Cultures, India, and the Society of Fermentation Technologists, a symposium on the "microbiological assay of amino acids, vitamins and other growth factors" was held on Saturday, the 17th December 1949, at the Indian Institute of Science, Bangalore. Dr. N. N. De, Assistant Professor of Pharmacology, presided on the occasion. The isolation and characterisation of micro-organisms from various sources and the factors which influence the choice of these organisms for purposes of assay, were described in considerable detail. The importance and need of a continued search for new and better organisms which, (1) can utilise bound forms of growth factors; (2) can be employed for the assay of "strategically important" peptides; (3) are more specific to the given constituent and less susceptible to interfering substances associated with natural extracts; and (4) are characterised by a higher stability and reproducibility of performance were stressed during the discussion.

A paper on the preparation of samples for assay discussed the relative merits of acids, alkalies and enzymes as hydrolysing agents. It was pointed out during discussion that the enzymatic hydrolysis of samples should be studied in greater detail to avoid the serious shortcomings of acid and alkali hydrolysates. In a paper on analytical methods employed, it was pointed out that counting of cells of the test organism in a drop of the assay medium can be adapted for estimating ultra-micro quantities of growth factors. An interesting and valuable paper explained the use of treated protein hydrolysates (a paper appearing elsewhere in this issue) as a substitute for mixtures of pure and expensive amino acids, now difficult to get. A description of the paper-strip chromatography technique to check the freedom of the treated casein hydrolysates from particular amino acids, was given. It was shown that the method is highly sensitive and is capable of establishing microbiological standards of purity. Following a paper on the "use of test organisms in the discovery of new factors", detailed papers on the organisms available for assay of amino acids and vitamins in the National Collection of Type Cultures, India (sponsored by the Council of Scientific and Industrial Research), were presented. The last paper dealt with the assay of trace elements and minor growth factors.

V. S. G.

TRIPS TO THE MOON BY 1960*

NEWSPAPERS of late have been full of contemplated trips to the moon. One scientist at Frankfurt, Germany, Dr. Heinz Gartmann, has been quoted as saying, "All we need now is the chance—and the financial aid—to put our theories into practice." It is stated that half the battle, the completion of basic theoretical calculations for the design of the moon rocket, has been won.

On this side of the ocean considerable publicity has come to members of the Canadian Rocket Society at Toronto. Captain E. J. Evans Fox, visiting New York, displayed a blueprint for a 200-foot-long craft driven by nuclear fission with tripod takeoff and landing equipment. He plans the moon as only a stopover point, and revives the economical year and a half Mars-Venus tour that was long ago designated the Hohmann Round Trip (see *Rockets*, Willy Ley, 1944). Captain Fox does not worry about the water and oxygen supply for his passengers, indicating that processes are already in use for the recovery of both of these from the products of combustion. And as for food, he says there is room for tons of it. We tend to be skeptical; but Boris Dyke, Vice-President of the Canadian Rocket Society, comes into the limelight with more data and even a prediction. In charge of the planning, he is quoted as saying that 1960 is not only a plausible date but the one toward which they are working for their trip to the moon.

While the most time-saving trip would require only 15 hours, plans are for a four-days-each-way trip in an elliptical orbit which would require less fuel by taking advantage of natural gravitational fields. The 1,000 ton ship would itself cost only about five million dollars; but Dyke estimates that hundreds of millions of dollars will first have to he spent on preliminary research and trials.

* By courtesy of *Sky and Telescope*, 1949, 9, 10.

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NOTE ON A CORRECTION BY LAPORTE TO OSTROFSKY'S FORMULAE

Since the completion of our work (1948) on the term values in the complex spectra of Cb I and Cb II, we noticed that Laporte (1942) had found discrepancies in the values given by Ostrofsky for the term values in d^4 configuration. He recalculated and obtained for the individual values of the term pairs $^1S_\pm$ and $^1G_\pm$ the following correct formulæ:

$$^1G_\pm = 6F_0 - 5F_2 - 6{\cdot}5F_4 \pm \tfrac{1}{2}(708\,F_2^2 - 7500\,F_2F_4 + 30825\,F_4^2)^{\frac{1}{2}}$$

$$^1S_\pm = 6F_0 + 10F_2 + 6F_4 \pm \tfrac{1}{2}(3088\,F_2^2 - 26400\,F_2F_4 + 133200\,F^2{}_4)^{\frac{1}{2}}$$

The error in Ostrofsky's values is just in the coefficient of F_2F_4—(Ostrofsky's values being 6420 and 2)340 respectively for ^1G and ^1S). The formulæ derived by the author (1948) for d^4s configuration which were originally based on Ostrofsky's values need slight modification on account of this change. But the values of the parameters as determined by us previously in both cases are not affected, as in the calculation of them the values of such high terms as ^1G and ^1S were not used. The mean values, too, are not affected. The slight effect is only on the calculated individual values of the terms in each pair. The percentage error in such cases is also

very small as can be seen below from a calculation for the two ^1G's.

	Ostrofsky	Laporte	Difference	Per cent.
Mean value	20126·5	20126·5	0	0
$^1G_+$	25490·2	24526·5	+963·7	4
$^1G_-$	14762·8	15726·5	−963·7	

The error is about 4 per cent. This is practically negligible. Hence calculations for the other pair are not made. But it might be noted that in all future calculations Laporte's formulæ might be used. The formulæ given by the author for d^4s also might be modified accordingly.

Andhra University, V. RAMAKRISHNA RAO.
Waltair,
September 20, 1949.

1. Laporte Otto, *Phy. Rev.*, 1942, **61**, 302,305. 2. Ostrofsky, *Ibid.*, 1934, **46**, 604. 3. Ramakrishna Rao, V., *Ind. J. Phy.*, 1948, **22**, 429.

ELASTIC CONSTANTS OF LITHIUM FLUORIDE

LITHIUM FLUORIDE is an ionic cubic crystal but its elastic constants as determined by Schæfer and Bergmann (1938), do not satisfy Cauchy's relation $C_{12}=C_{44}$. Sundara Rao (1949) has recently found better agreement but even according to him, C_{12} and C_{44} differ by as much as 16%. An exceptionally clear and artificially grown crystal was put at my disposal by Prof. Bhagavantam and it was thought desirable to repeat the measurements.

Sections (001) and (011) of different thicknesses (1·790 to 1·983 mm.) have been cut from this sample and used. Ultrasonic velocities in these plates are determined by the wedge method, using frequencies in the range 1 to 12 mc./sec. and the elastic constants are evaluated in the usual manner. The density of the substance as determined by the author is 2·635 gm./cm.^{3}, and agrees well with the average value 2·640 given in Landolt-Börnstein Tables (1927). The bulk modulus K along with the elastic constants (10^{11} dynes/cm.^{2}) and the elastic coefficients (10^{-13}cm.^{2}/dyne) are given below.

No.	Observer	C_{11}	C_{12}	C_{44}	S_{11}	S_{12}	S_{44}	K
1	Schæfer & Bergmann	11·8	4·34	6·28	10·6	−2·85	15·9	6·82
2	Sundara Rao	11·9	4·58	5·42	10·7	−2·97	18·5	7·02
3	Author ..	11·9	5·38	5·34	11·7	−3·64	18·7	7·55
4	Slater ..	..	..	..	..	..	..	8·55

The author's values for C_{11} and C_{44} are in good agreement with those of Sundara Rao while that for C_{12} is higher. According to the present measurements, Cauchy's relation is satisfied to a high degree of accuracy. It is interesting to note that the author's value for K is nearer Slater's (1931) value determined by direct experiment.

The author is very much indebted to Prof. S. Bhagavantam for his valuable guidance.

Dept. of Physics, T. SESHAGIRI RAO.
Andhra University,
Waltair,
November 22, 1949.

1. Landolt-Börnstein, *Physikalisch-Chemische Tabellen*, 1927, Erg. Bd., 1, **5**, 176. 2. Schæfer & Bergmann, see "Ultrasonics" by Bergmann, 1938, 180. 3. Slater, J. C., see "The Physics of High Pressure" by Bridgman, 1931, 163. 4. Sundara Rao, R. V. G., *Curr. Sci.*, 1949, **18**, 336.

RAMAN SPECTRUM OF METHYL METHACRYLATE GLASS

THE Raman spectrum of methyl methacrylate both in the liquid form and as glass has been investigated by Hibben[1] to elucidate the mechanism of polymerisation, but unfortunately, no photograph of the spectrum was reproduced. As a large transparent rectangular specimen of methyl methacrylate glass (plexi-glass) supplied by the Imperial Chemical Industries Ltd., was available in the laboratory, the author undertook an investigation of its Raman spectrum. The specimen not being transparent in the ultra-violet region, its spectrum had to be excited by using the visible radiations of the mercury arc. The spectrum exhibited weak fluorescence between λ 4200 to λ 5000, but satisfactory spectrograms were obtained by using a filter of a strong solution of sodium nitrite.

In the photograph (Fig. 1), taken with a Hilger 2-prism spectrograph, after twelve hours' exposure, fifteen Raman lines are easily discernible, the frequency shifts being 231 (0,*d*), 295 (0,*d*), 360 (1,*d*), 491 (1,*d*), 606 (3), 817 (7), 982 (4,*b*), 1129 (1), 1176 (0) 1455 (5), 1598 (1), 1729 (5) 2876 (0), 2934 (3), 3001 (1) cm.$^{-1}$ The figures

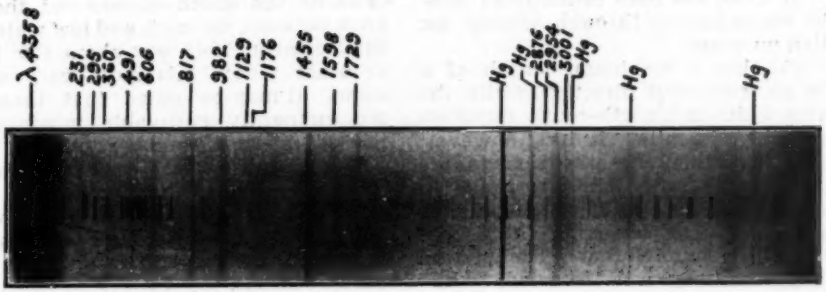


FIG. 1. Raman spectrum of plexi-glass.

in brackets represent rough estimates of the relative intensities of the lines. b= broad, d = diffuse. Besides confirming the frequency shifts already reported by Hibben, the three lines 231, 1176 and 1598 have been recorded for the first time. The appearance of the 1598 line in the spectrum of plexi-glass is very significant. It is in all probability due to C=C oscillation. The spectrum of methyl methacrylate liquid exhibits a line at 1638 cm.$^{-1}$ corresponding to C=C oscillation. Its absence in the spectrum taken by Hibben led him to conclude that the coupling of the molecules on polymerisation took place by the breaking of the C=C double band. This conclusion has to be revised in the light of the present investigation.

The author is grateful to Prof. R. S. Krishnan for suggesting the problem.

Department of Physics, M. M. PATEL.
Indian Institute of Science,
Bangalore,
November 24, 1949.

1. Hibben, *Jour. Chem. Phys.*, 1937, **5**, 706.

SPECTRUM OF MONOBROMOBENZENE

FOLLOWING the work on the ultra-violet absorption spectrum of iodobenzene,[1] that of bromobenzene was studied under similar conditions. The absorption bands extending from λ 2300 to λ 2350 consist of about 150, appearing in a number of groups. As reported earlier by Walerstein[2] and also referred to by Sponer and Teller,[3] the spectrum is a combination of the allowed transitions due to C_{2v} symmetry of C_6H_5Br and of the forbidden transitions of the benzene structure. The totally symmetrical carbon vibrations of 933,963 and 1020 in the upper state, the difference frequency 60 are evident in the structure of one set of the intense groups. The second set of intense bands displaced by about 520 cm.$^{-1}$ is also obtained. In addition, as observed in similar spectra of aniline,[4] phenol,[5] fluorobenzene,[6] several of the intense heads show a splitting into doublets with an average separation of about 6 cm.$^{-1}$ An additional difference frequency 221 cm.$^{-1}$, not reported previously, is also established. The most intense band of the group in the region near ν 38900 corresponds to (0+966 +932), while the overtone (0+2 × 1020) is absent.

Full details will be reported elsewhere.

Andhra University, K. SREERAMAMURTY.
Waltair,
November 22, 1949.

1. Sreeramamurty, K., and Rao, K. R., *Curr. Sci.*, in press. 2. Walerstein, *Phy. Rev.*, 1941, **59**, 924. 3. Sponer and Teller, *Rev. Mod. Phys.*, 1941, **13**, 75. 4. Ginsburg and Matsen, *J. Chem. Phys.*, 1945, **13**, 167. 5. Matsen, Ginsburg and Robertsen, *Ibid.*, 1945, **13**, 309. 6. Wollman, *Ibid.*, 1946, **14**, 123.

GEOGRAPHICAL INVESTIGATION OF THE GOKALPUR LAKE NEAR JUBBULPORE

THE important lake, situated north of Gokalpur village, is about two miles E.N.E. of Jubbulpore, over 1,300 feet above sea level and is put to multipurpose use. There is a depression, forming a natural rock basin in the granitic country with blocks of granite rising in some places above its surface. The north and the west are bounded by granitic hills, while on the north-west there is a natural

outlet. A bund has been constructed now and the water flowing through is used for irrigation purposes.

The lake has a maximum length of a mile in an east-west direction, while the maximum width in a north-south direction is four-fifths of a mile. It has, however, an irregular outline with extensions in the east, west and south. The low range in the north is studded with numerous granitic hills, about 100 feet high, the higher ones rising to about 150 feet. The western end is particularly well forested, while the eastern end is bare. The following trees, shrubs and climbers, deciduous in character, occur on the granitic hills above the north-western corner of the lake :—

Shorea robusta, Butea frondosa, Garuga pinnata, Odina Wodier, Buchanania latifolia, Agoneissus pendula, Phyllanthus Emblica, Acacia Catechu, Helicteres Isora, Ziziphus Oenoplia, bamboo, which is thin and wiry and *tendu*.

In the west there is a low and broken chain of hills, with the maximum height of about 100 feet. Towards the south-west corner there is high ground again, where a cluster of blocks of granite is to be observed. Adjoining the college buildings of the Mahakoshal Mahavidyalaya on the south-east is low ground traversed by streams feeding the lake, during the monsoon. It may be noted, therefore, that the shoreline in the north and some distance on the west is rocky, while in the south and south-east it is alluvial through the deposition brought by the incoming streams.

On the banks of the lake, aquatic vegetation, particularly water hyacinth (*Eichhornia crassipes*) along with *Carex Wallichiana*, grass and bushes are to be seen. The extent of this aquatic vegetation is variable. When the rocks come close to the shore, this aquatic vegetation is restricted in extent. When the rocks project into the lake no aquatic vegetation is seen. Aquatic vegetation, particularly water hyacinth, extends for a considerable distance towards the south, *viz.*, the direction in which the stream flows from Gokalpur. The aquatic vegetation in the lake itself deserves study by a botanist.

On the west is a bund for controlling the flood level. Beyond the bund there is a channel which serves as an inundation canal during the monsoon. In the rainy season, the water rises by about 2 ft. as compared to the level in December, 1948. Towards the south-eastern end the difference between the high and low water levels in December, 1948 was about 100 feet, but at other places this must vary with the slope. It may be noted that these banks are eminentiy cultivable in winter since the soil is rich in humus.

The lake is fed also by the Pariat tank, so as to minimise the fluctuations in lake level. It also supplies drinking water to Jubbulpore. During the monsoon, its water is used for rice cultivation and in the other seasons, for raising sugarcane and vegetables in the surrounding villages, *viz.*, Katia, Bedla, Suhagi, Amkhera, etc.

The detritus from small streams pouring into it must be, gradually, making the lake shallower. It may be pointed out that those in charge of the lake would kindly see that it does not reduce in size or degenerate into a marshy depression as a result of this deposition. It is even likely that it has been already reduced in size in the south-east. Measures to counteract this effect are urgently called for. Fisheries and sport can be developed in this somewhat large reservoir so close to Jubbulpore. Finally, there is no denying the fact that the lake must have a salubrious effect on the climate of the neighbourhood.

Dept. of Geography, H. L. CHHIBBER.
Benares Hindu University,
July 29, 1949.

ON ORGANIC REMAINS FROM THE VINDHYANS (PRE-CAMBRIAN)

ATTENTION has been drawn to the occurrence of organic-like forms (Chapman,[1] M. R. Sahni,[2] Fox,[3] Auden,[4] and Rode[5]) in the Vindhyans. The most convincing evidence for it comes from the Suket shales from a horizon at the junction of the Lower and Upper Vindhyans, roughly equivalent of the Rohtas stage of the Son Valley, from which Chapman described some primitive brachiopods. These were later revised and redescribed under a new family Fermoriidae by M. R. Sahni.[2] The author has made a collection of rocks with structures suggestive of organic origin from the Lower Vindhyans of the Son Valley and Karwi area, Banda District, U.P., and a preliminary note (Misra[6]) was published on a previous occasion. The present note records three forms, indicative of organic origin.

1. Glauconite Grains Occurring as Casts of Organisms

A detailed study of the sandy glauconitic limestones from the Lodhwara hill (25° 13′-80° 55′) north of Karwi overlying the Bundelkhand granite, shows much glauconite in two distinct forms: (1) rounded, ovoid, and sausage shaped bodies (see Fig. 1)

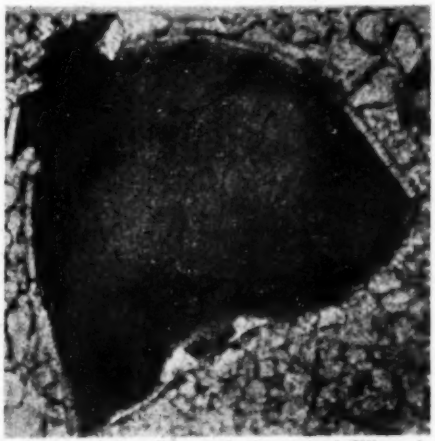


Fig. 1. A broken piece of glauconite infilling of an organism. ×110. *Loc.*—Lodhwara Hill, Karwi, Banda District, U. P.

with clearly defined boundary walls and (2) irregular particles without any wall structures. The wall material in (1) is either transparent (Fig. 1) or (2) opaque consisting of carbonaceous matter. The carbonaceous nature was confirmed by strongly heating a thin slice on platinum foil. It may be noted that Sederholm[7] figured bodies with boundary walls of carbonaceous matter from the Pre-Cambrian rocks of Finland and he considered them to be carbonised remains of very primitive plants. The forms I have figured therefore appear to be infillings of some organisms. A very striking result is obtained by treating uncovered slides with safranin. While the calcereous matrix and the detrital grains of quartz remain unaffected, the glauconitic bodies stain a brilliant brownish red.

2. Remains of Alga (Fig. 2)

The carbonaceous limestones collected from the Banjari quarries (south of Dehri-on-Sone, on the Dehri-Rohtas Light Railway) which come from a horizon towards the top of the Rohtas stage have yielded a microscopic verticillate alga with a slender jointed stalk terminated by a globular head. The dark portions (seen in the photo) are carbonaceous and represent the original protoplasmic matter. The globular head consists of radiating black carbonaceous patches and represent fertile sporangia. The dark segments in the stalk appear to represent verticillate deciduous sterile branches (see Fig. 2). The earliest

Fig. 2. An alga (Dasycladacea). ×110. *Loc.*—Banjari, Shahabad District, Bihar.

known Dasycladaceae, are from Ordovician rocks: the genera described are *Cœlosphæridium*, *Cyclocrinus* and *Apidium* from the Ordovician of the Baltic region, and all these are characterised by a globular head consisting of radially spreading branches at the top of the axis as in the Vindhyan alga. It may be further noted that from the Ordovician of Spiti, Cowper Reed[8] described *Cœlosphæridium shianensis* [= *Pasceolus* (?) *shianensis* Reed].

I am grateful to Prof. S. R. N. Rao, for identification of the alga and helpful suggestions.

Department of Geology, R. C. Misra,
University of Lucknow,
Lucknow,
November 15, 1949.

1. Chapman, F., *Rec. Geol. Surv. Ind.*, 1935, **69**. 2. Sahni, M. R., *Ibid*, 1936, **6**). 3. Fox, C. S., in Auden, J. B., *Mem. Geol. Surv. Ind.*, 1933, **62**. 4. —, *Intern. Geol. Congr.*, Moscow, 1937. 5. Rode, K. P., *Curr. Sci.*, 1946. 6. Misra, R. C., *Proc. Ind Sci. Congr.*, 1947. 7. Sederholm, *Centralbl Min. Geol. Palæont.*, 1925. Abt. B, No. 11. 8. Reed, *Pal. Ind.* Ser. XV, 7.

INFLUENCE OF VITAMIN C ON PHOSPHORYLASE

PHOSPHORYLASE was prepared by fractionating fresh potato juice with ammonium sulphate as described by Bourne, *et al.*[1] Glucose-1-phosphate was prepared by Hanes[2] method.

The phosphorylase activity was determined according to the method described by Green, *et al.*[3]

The reaction mixture contained 1 ml. of enzyme, 1 ml of citrate buffer (pH 6·0), 1 ml. of 0·1 M glucose-1-phosphate in citrate buffer of pH 6·0 and 1 ml. of each of the substances added, the total volume being adjusted to 6 ml. Temperature of incubation was 35° C. The results are presented in the following table.

Reaction mixture	Activity of phosphorylase expressed as mgm. of Ing. P. formed in the total digestion mixture in 10 minutes	Percentage inhibition
Phosphorylase alone ..	0·4752	..
Phosphorylase + Vit. C (5 mgm.)	0·3268	31
Phosphorylase + Vit. C (5 mgm.) +Cu (15γ) as copper sulphate ..	0·2099	56
Phosphorylase + Vit. C (5 mgm.) +Cu (15γ)+ sodium oxalate (20 mgm.)	0·4752	0
Phosphorylase + Vit. C (5 mgm.) +Cu (15γ) + sodium diethyl dithiocarbamate (5 mgms.) ..	0·4752	0
Phosphorylase + Vit. C (5 mgm.) +Cu (15γ) + 8-oxy-quinoline (5 mgm.)	0·4752	0

The results obtained are similar to those obtained in the case of other enzymes studied in this laboratory. Further work on the exact mechanism of the action of the substances in annulling the inhibition produced by vitamin C-Cu complex is in progress. Full details of the work will be published elsewhere.

Dept. of Biochemistry, J. SRI RAM.
I. I. of Science, K. V. GIRI.
Bangalore,
August 10, 1949.

1. Bourne, E. J., and Peat, S., *Jour. Chem. Soc.*, 1945, 877. 2. Hanes, C. S., *Proc. Roy. Soc.*, 1940, **129B**, 174. 3. Green, D. E., and Stumpf, P. K., *Jour. Biol. Chem.*, 1942, **142**, 355.

SYNTHESIS OF SACCHARIN FROM ANTHRANILIC ACID

THE most common method of preparation of saccharin is based essentially on the original method of Remsen and Fahlberg[1] through the conversion of toluene to *o*-toluenesulphonyl chloride and thence to the corresponding amide, and oxidation of the latter to saccharin. It has been reported[2] that during the war the Germans synthesised saccharin from anthranilic acid. The principal steps in the synthesis as described in the German patents[3] issued to Ciba are: (1) diazotisation of methyl anthranilate and conversion to *o*-carbmethoxybenzenesulphinic acid, (2) conversion of the latter to *o*-carbmethoxybenzenesulphonyl chloride, and (3) preparation of saccharin (*a*) from the sulphonyl chloride by the action of ammonia or (*b*) directly from the sulphinic acid. Though all these basic reactions are known, scanty information is available in literature on them and particularly about the preparation of saccharin by this method.

A systematic study has now been made on the preparation of a number of sulphinic acids from the corresponding amino compounds as well as on the conversion of these sulphinic acids to sulphonamides either directly or through the corresponding sulphonyl chlorides. The existing methods have been modified where necessary to get optimum yields. The results have then been applied to the preparation of saccharin from anthranilic acid when about 70% yield calculated on anthranilic acid was obtained.

This method is worth considering as a possible manufacturing process in India. It may be noted that the chief difficulty in adopting the 'Remsen-Fahlberg process' for India is the non-availability of cheap chlorosulphonic acid, whose manufacture in India has not yet been established and is difficult. The economic feasibility of the present process, in which the plant requirements would be simpler, would depend upon the price at which anthranilic acid would be available. A detailed account of the work will shortly be published elsewhere.

Organic Chem. Laboratories, N. B. DALAL.
Royal Institute of Science, R. C. SHAH.
Bombay,
November 17, 1949.

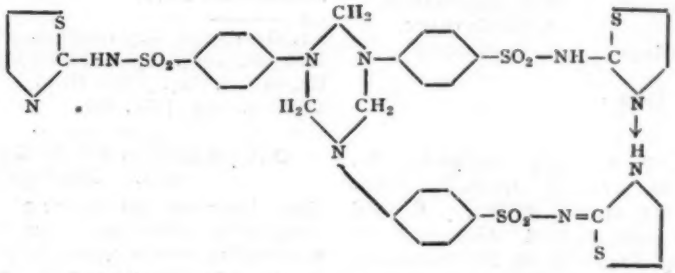
1. Remsen and Fahlberg, *Ber.*, 1879, **12**, 469, 2. *Chemi. Industries*, 1946, 787. 3. *D.R.P.*, 130, 119 (*Frdl.*, **6**, 64-65) and *D.R.P.*, 122567 (*Frdl.*, **6**, 1208).

CHEMICAL STRUCTURE OF THE CONDENSATION PRODUCT OF FORMALDEHYDE WITH SULPHATHIAZOLE

BHATNAGAR AND FERNANDES[1] have attributed a new mechanism of drug action to the formaldehyde derivatives of 2 *p-aminobenzenesulphanilamidothiazole* on account of their property of selective tissue localization in organs rich in reticulo-endothelial system of cells, and have envisaged the possibility of their application to those clinical conditions in which the pathogens are intracellularly located.

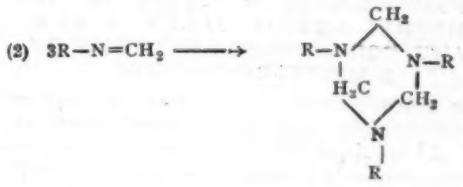
Chemical and analytical studies on this new chemotherapeutic agent so far[2,3,4] point to the condensation of formaldehyde with sulphathiazole on 1 Mol : 1 Mol basis, resulting presumably in a polymer in which the sulphamyl and the aromatic NH_2 groups participate in loose combination with, perhaps, methylene bridge formation. Although the condensation product behaves as a Schiff's base—as for example in its reactions with SO_2 and $NaHSO_3$—its constitution as would fit into the summary formula ($C_{10}H_9O_2N_3S_2$) has not been found yet, owing to its insolubility in sodium hydroxide and the difficulty of splitting it with acids.

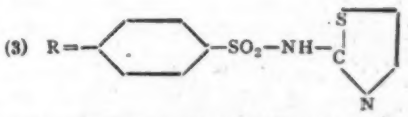
In our experiments on the chemical nature of this condensation product, an interaction took place between formosulphathiazole and Na_2CO_3 in a proportion (15·1 g. : 2·0 g.) which strongly indicated that this reaction was only possible if 3 Mols of formaldehyde were to condense with 3 Mols of sulphathiazole in the original product since we obtained a sodium salt of unusually high molecular weight (actual 801, found 802). Further proof that this was so was obtainable from colorimetric studies, after diazotisation and coupling, of different acid solutions of the sodium salt, prepared in the manner of sulpha standards with trichloracetic acid, which on boiling for half an hour yielded approximately 3 times as much diazotisable substance as before the application of heat. On this basis and the study of physico-chemical behaviour we are led to suggest the following molecular configuration for formosulphathiazole, analogous to that of hexa-methylene-tetra-amine.[5] Trimers of an allied nature, different in composition and structure, are known to exist.[6]



The mode of condensation is formulated in the following equation: —

(1) $3CH_2O + 3H_2N-R \longrightarrow 3R-N=CH_2$





In contrast to other aldehydes which give rise to normal Schiff's bases, the formation of cyclic trimethylene derivatives is peculiar to formaldehyde. The behaviour of formosulphathiazole as a Schiff's base in its reactions towards $NaHSO_3$ was found by us to be limited to equimolecular proportions. In view of the chemical structure proposed this would indicate that a weakly acid radical would only interact with one CH_2-N

grouping, no further decomposition taking place. A similar experience with hexamethylene-tetra-amine when reacting with HCl is obtainable. The formation of only a disodium salt with Na_2CO_3 in the presence of three reactive hydrogen atoms is explained by the existence of only two of these being free in $-SO_2-N=C$ groups, the third one having been isomerised to $-SO_2-N-C$ combination and having been stabilised by chelation.

Further work on the suggested chemical structure is in progress.

Dept. of Chemistry and Caius Research Laboratory, St. Xavier's College, Bombay,
November 22, 1949.

V. V. NADKARNY.
S. S. BHATNAGAR.
A. N. KOTHARE.
F. FERNANDES.

1. Bhatnagar, S. S., and Fernandes, F., *Nature*, 1949, **164**, 272. 2. Druey, J., *Helv. Chem. Acta.*, 1948, **31**, 179. 3. Druey, J., and Becker, A., *ibid.*, 1948, **31**, 2184. 4. Basu, U. P., *Jour. Ind. Chem. Soc.*, 1949, **26**, 125. Duden, P., and Scharff, M., *Ann.*, 1395. **288**, 218. 6. Walker, J. F., "Formaldehyde," Reinhold Publishing Co., New York, 1944.

FRIEDEL-CRAFTS ACYLATION OF METHYL β-RESORCYLATE : A NEW AND CONVENIENT SYNTHESIS OF 2-ACETYLRESORCINOL

By Friedel-Crafts acetylation of methyl β-resorcylate with acetic anhydride Desai, *et al.*[1] obtained methyl 2, 4-dihydroxy-5-acetylbenzoate (I) but no γ-isomer, methyl 2, 4-dihydroxy-3-acetylbenzoate (II). It is now found however, that besides (I) and a small quantity of methyl 2, 4-dihydroxy-3, 5-diacetylbenzoate, (II) is formed in considerable quantities (*Ca* 25% yield). The structure of (II) is established by hydrolysis and decarboxylation to 2-acetylresorcinol: it is quantitatively converted directly to the latter by heating with 10% sodium hydroxide solution on steam-bath for three hours. Similarly 2-propionylresorcinol could be obtained and the reaction thus appears capable of providing convenient syntheses of 2-acylresorcinols which are generally obtained indirectly by the method of Limaye,[2] by the hydrolysis of 7-hydroxy-4-methyl-8-acyl-coumarins.

This formation of (II) is however only to be expected for methyl β-resorcylate gives 3-formyl derivative in the Gattermann reaction according to Shah and Laiwalla[3] and the 5-hydroxy-coumarin derivative as the main product in the Pechmann reaction as shown by Sethna, Shah and Shah.[4] Extension of this reaction for the syntheses of 2-acylresorcinols is in progress and results will shortly be published elsewhere.

Our grateful thanks are due to Dr. R. C. Shah for his kind interest in this work.

Organic Chem. Labs., Royal Inst. of Science, Bombay,
October 22, 1949.

P. L. TRIVEDI.
SURESH SETHNA.

1. Desai and Ekhlas, *Proc. Ind. Acad. Sci.*, 1938, **8A**, 194 ; Desai and Radha, *Ibid.*, 1940, **12A**, 46 ; 2. *Ber.*, 1934, **67**, 12 ; 3. *J.C.S.*, 1938, 1828. 4. *Ibid.*, 1938, 228.

OCCURRENCE OF FUNGI INSIDE RICE KERNELS

THE study on the nature of action of the fungicides "Spergon" and "Phygon" in preventing loss of viability of paddy seeds in storage Ramiah and Padmanabhan,[1] (1949) has revealed that even apparently healthy seeds contain an internally borne fungus, which may be cultured artificially. The fungus that occurred most was *Trichoconis padwickii* Ganguly (Padwick and Ganguly,[2] 1945; Ganguly,[3] 1946). The method employed in culturing the seeds and the results obtained are given below.

Four ounces of seeds of five local types, T. 90, T. 412, T. 812, T. 1145, and T. 1242, were kept in equilibrium with six different relative humidities in desiccators with sulphuric acid dilutions in the beginning of May, 1949. During the first week of June and the third week of July samples were drawn from the desiccators and tested for the presence of surface-borne and internally borne fungi. No distinction was made between the apparently healthy seeds and the small percentage of visibly spotted ones.

The seeds were made to stand for 1 hour in 10 c c. of sterile water in test-tubes and washed in a single change of sterile water. They were then surface sterilised in mercuric chloride solution (one minute in 1 :1000), washed again in four changes of sterile water and sown in thin oat-meal agar plates. A week after sowing, observation was taken on germination and the fungus, if any, growing from the seed, was identified.

The seeds germinate in 24 to 48 hours. After the emergence of the radicle and the plumule, when the latter is about a centimetre in length, a white tuft of mycelium grows out of the seed, at the base of the plumule, or in rare cases from the opposite end also. The mycelium grows slowly and establishes itself in the medium, forming characteristic sclerotia. The fungus is easily recognised by its compact light-olive gray colour, velvetty surface as well as by its sclerotia (Fig. 1). Characteristic *Trichoconis* stage of the fungus is readily obtained by cutting out a portion of the medium along with the fungus and placing the same in a moist chamber. A variant with light-pink thallus is also met with occasionally. This imparts the same pinkish colour to the medium.

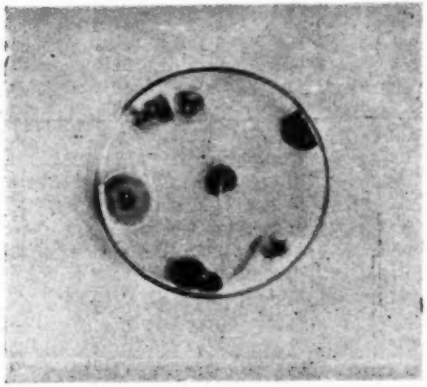


Figure showing seven seeds of T. 812 with pure grwoths of *Trichoconis padwickii* × ¼ Nat. size.

Table gives the percentage of seeds with fungi growing out of them.

Type of paddy	Percentage of seeds infected by fungi			
	All fungi	*T. padwickii*	Other than *T. padwickii*	Unidentified fungi
T. 90 ..	87·0	64·6	1·80	20·6
T. 1145 ..	91·0	68·5	7·99	14·5
T. 812 ..	93·0	76·0	8·7	8·3
T. 412 ..	81·5	56·5	11·6	13·4
T. 1242 ..	85·4	51·3	23·45*	10·75

* A number of seeds in this variety had spots; this explains the high percentage in Col. 3.

It will be seen that more than 80-90 per cent. of the seeds had harboured an internal fungus though they were apparently healthy. *T. padwickii* occurs most in these seeds (51-76%). The percentage of unidentified growth varied from 8 to 20%. The other fungi identified were *Curvularia lunata* Boedj. *Ophiobolus miyabeanus* I to and Kuribay. = (*He lminthosporium oryzæ* Breda de Haan) and *Nigrospora oryzæ* (B. & Br.) Petch.

T. caudata has been reported to be associated with deterioration of paddy seeds in storage and from the condition created by the presence of the fungus in paddy stack, the disease was called "Stack-Burn," (Tisdale,[4] 1922). Ganguly[3] showed that *T. padwickii* is a weak pathogen on rice causing leaf and grain spot without doing great damage to the crop.

S. Y. Padmanabhan.

Central Rice Research Institute,
Cuttack-4, Orissa,
October 13, 1949.

1. Ramiah, K., and Padmanabhan, S. Y., *30th Proc. Indian Science Congress*, 49. 2. Padwick, G. W., and Ganguly, D., *Curr. Sci.*, 1945, **4**, 328-29. 3. Ganguly, D., *Journ. Indian Bot. Soc.*, 1947, **25**(4). 233-39. 4. Tisdale, W. H., *U. S. D. A. Bull.*, 1922, No. 1116.

THE EFFECT OF WATER-LOGGING ON THE CHEMISTRY OF SUGARCANE JUICE

Except for a few crops like paddy and jute, water-logging is detrimental to crop production. Knee deep water-logging in cane fields has been found to affect sugar recovery adversely and to create difficulties in manufacture.

In view of the importance of non-sugars[2,4,5,6] in determining manufacturing qualities of juices, an examination of the changes brought about by water-logging in respect of these constituents was considered worth while.

Two varieties of cane (Co. 453 and B.O. 3) grown under water-logged conditions (submerged from July to September up to a maximum height of 4 ft.) were under examination. Samples were drawn in December and non-sugar constituents in their juices (Table I) compared with those in

TABLE I

Juice attributes and interlogging in canes

Sl. No.	Item*	Water-logged cane			Normal cane			Per cent change † due to water-logging
		Maximum	Minimum	Average	Maximum	Minimum	Average	
		(*a*) Variety: C.O. 453						
1	Brix	19·00	18·30	18·73	22·50	21·05	22·08	− 15·1
2	Polarisation	14·03	12·31	13·15	18·49	18·23	18·37	− 28·3
3	Purity	76·70	65·80	70·28	86·89	81·93	83·27	− 15·6
4	Invert sugars	7·26	5·53	6·60	1·46	0·95	1·23	+436·5
5	Total colloids	6·45	5·79	6·20	5·00	3·90	4·36	+ 42·2
6	Gums	4·45	3·92	4·17	0·74	0·60	0·68	+513·2
7	Calcium pectate	0·33	0·24	0·29	0·18	0·14	0·16	+ 81·2
8	Total organic nitrogen	0·53	0·28	0·43	0·33	0·29	0·32	+ 34·4
9	"Harmful" nitrogen	0·47	0·26	0·39	0·23	0·22	0·22	+ 77·3
10	Ash	7·26	6·89	7·03	3·74	3·42	3·63	+ 93·6
11	P_2O_5	0·12	0·09	0·11	0·11	0·07	0·10	+ 9·1
12	"Harmful" nitrogen per cent. total organic nitrogen	94·2	86·6	89·5	74·5	66·7	69·3	+ 29·1
		(*b*) Variety: B.O. 3						
1	Brix	20·10	18·80	19·57	23·65	22·40	22·99	− 14·9
2	Polarisation	14·12	12·09	13·48	19·37	17·89	18·42	− 26·8
3	Purity	70·70	64·30	68·78	86·47	75·64	80·19	− 14·2
4	Invert sugars	7·66	5·74	6·67	2·70	1·30	1·80	+270·6
5	Total colloids	7·51	6·45	6·85	3·28	2·73	2·93	+133·7
6	Gums	4·28	3·31	3·85	0·68	0·53	0·58	+563·8
7	Calcium pectate	0·28	0·18	0·21	0·12	0·11	0·12	+ 75·0
8	Total organic nitrogen	0·56	0·33	0·46	0·37	0·24	0·32	+ 43·8
9	"Harmful" nitrogen	0·48	0·27	0·38	0·23	0·16	0·20	+ 90·0
10	Ash	7·12	6·26	6·78	3·03	2·82	2·02	+132·1
11	P_2O_5	0·13	0·08	0·10	0·11	0·09	0·10	0·0
12	"Harmful" nitrogen per cent. total organic nitrogen	87·3	78·1	84·6	66·7	52·2	61·7	+ 37·1

* Item 4 to 11 are expressed as percents on total solids. † Percentages refer to the average values.

juices from canes grown normally under otherwise identical conditions. The analytical methods employed were those referred to in a previous communication[3] except for non-protein or "harmful" nitrogen[1] which followed that of Unverdorben and Spielmeyer.[7]

CONCLUSIONS

(1) Against a 30% drop in polarisation, invert sugars, total colloids, gums, pectin, non-protein nitrogen and ash increase due to water-logging, the rise for invert sugars and gums being of a high order.

(2) 90% of total nitrogen exists as non-protein (or "harmful") nitrogen, thus accounting for the poor technological properties of water-logged cane juices and losses in sugar recovery.

Thanks are due to the Government of Bihar and the Indian Central Sugarcane Committee for financing this work.

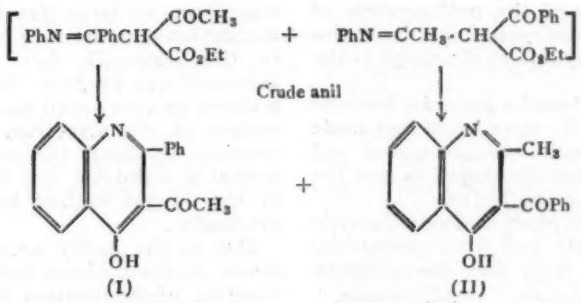
K. L. KHANNA.
A. S. CHACRAVARTI.

Central Sugarcane Research Station,
Pusa (Bihar),
September 29, 1949.

1. Browne and Zerban, *Sugar Analysis* (New York), 1941, p. 1086. 2. Hornby and Kasjanov, *Zeit Zuckerind. Czechoslov.*, 1939, **63**, 187. 3. Khanna and Chacravarti, *Curr. Sci.*, 1949, **18**, 19. 4. Kortscher, *Hawaiian Planters' Record*, 1939, **43**, No. 1 (October). 5. Ness, *Internat. Sug. Jour.*, 1941, **43**, 378. 6. Soragato, *Ibid.*, 1936, **38**, 532. 7. Unverdorben and Spielmeyer, *Zeit. Ver. Deut. Zuckerind.*, 1939, **89**, 616.

A NEW SYNTHESIS OF 4-HYDROXY-2-PHENYL-3-ACETYLQUINOLINE

THE condensation product of benzanilide imidochloride with ethyl sodioacetoacetate on cyclization leads to the otherwise inaccessible 4-hydroxy-2-phenyl-3-acetyl-



quinoline (I).[1] It is now found that (I) could also be readily obtained by the application of the Conrad and Limpach method: the crude anil from aniline and ethyl benzoylacetoacetate (prepared by using a trace of hydrochloric acid as a catalyst) cyclises to (I) in good yields by heating in diphenyl ether. This observation confirms also its constitution suggested by Desai and Shah.[1] In this reaction an isomeric product found identical with 4-*hydroxy*-2-*methyl*-3-*benzoylquinoline*[2] (II) obtained by Thakor and Shah[2] by Friedel-Crafts benzoylation of 4-hydroxy-2-methylquinoline, is also formed in small quantities.

It is interesting to note that in the above condensation with aniline, C-benzoyl ethyl acetoacetate gives good yields of (I) and (II); as with ethyl benzoylacetate only poor yields of the corresponding quinolines are obtained,[3,4] although ethyl acetoacetate itself affords 4-hydroxyquinolines readily.[3]

S. A. KULKARNI.
V. M. THAKOR.
R. C. SHAH.

Organic Chem. Labs.,
Royal Institute of Science,
Bombay,
October 27, 1949.

1. Desai and Shah, *J. Indian Chem. Soc.*, 1949, **26**, 121. 2. Unpublished work. 3. *Ber.*, 1887, **20**, 944, 948; 1888, **21**, 521, 523; Limpach, *ibid.*, 1931, **64B**, 969, 970; 4. Elderfield, *et al.*, *J. Amer. Chem. Soc.*, 1946, **68**, 1212.

ON THE BIOLOGICAL CONTROL OF *STRIGA* SPECIES

IN his note (*Curr. Sci.*, 1949, **18**) on the caterpillar of *Precis oritya*, *Swinhœi* L. feeding on *Striga* spp., a parasite of sugarcane and jowar, Mr. D. V. M. refers to Prof. Kumar' sreport (Kumar, L. S. S., 1939) on a certain caterpillar feeding on *Striga densiflora*. Presumably Prof. Kumar recommended this caterpillar for the eradication of *Striga*. Early in 1935 the author[2] encountered a similar case of attack of *Striga Lutea* (Lour) occurring on the hill paddy in Malabar, by the grubs of a beetle identified as belonging to Galerucine subfamily by the Government Entomologist, Coimbatore. The grubs were found to be highly predatory on *Striga* sparing no parts of it, including the stem, leaves and the pods. Large-scale rearing of this beetle for the biological control of *Striga* in infested rice fields was suggested by the author.

Agri. Res. Institute, P. UTTAMAN.
Coimbatore,
October 10, 1949.

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MOUND-FORMING TERMITES AND THEIR CONTROL

DURING our investigation on white-ants and mound-forming termites, the following interesting observations have been recorded:

A mound is 'live', if repairs are done immediately on breaking open one of the 'towers'.

By placing a powerful magnetic compass at the centre of a mound, it is possible to locate the position of the 'Queen'. The 'Queen' invariably lies nearly parallel to the magnetic N and S in her cell which is on the NE or in a very few cases SW of the central point of the 'live' mound.

The 'fungus gardens' differed in different mounds not only in construction but

also in the manner of the proliferation of their hyphæ. Like an expert gardener the termites keep the hyphæ as if pruned to the very minimum.

In the control of termite mounds, benzene hexachloride, D.D.T., pyrethrum and crude oil, in various formulations, were used and a technique has been developed to get the best results by their application.

Thanks are due to Messrs. Geigy Insecticides Ltd., of Bombay, and other insecticidal concerns for their help and co-operation.

Maharashtra Association for the Cultivation of Science, Poona 4, *November* 14, 1949. P. J. DEORAS.

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THE INFLUENCE OF AVAILABLE CARBOHYDRATES UPON AMMONIA ACCUMULATION BY *PENICILLIUM NOTATUM* WESTL.

THE role of available carbohydrates on ammonia accumulation with reference to *Aspergillus niger* van Tieghem, was first explained by Waksman[4] and later by Thakur and Norris[2] with reference to certain soil fungi.

The present work deals with a determination of the effect of the available carbohydrates on ammonia accumulation by *Penicillium notatum* Westl. obtained from the Indian Agricultural Research Institute, New Delhi.

Four litres of a medium composed of :— Peptone, 20 gm.; K_2HPO_4, 1·0 g. ; $MgSO_4$, 0·5 g.; KCl, 0·5 g.; $FeSO_4$, 0 01 g.; and dist. water 1,000 ml. 2% Dextrose (anhydrous, C.P.) was added to two litres of medium, and the other two litres were left without any dextrose. 100 c.c. of the medium was poured in 200 c.c. Erlenmeyer flasks and autoclaved at 15 lbs. pressure for 15 minutes. The rest of the procedure was almost the same as that adopted by Waksman.[4]

Dextrose in the medium had a marked effect on the accumulation of ammonia. In the medium lacking in dextrose though the growth of the fungus was slow, as was apparent from the dry weights of the mycelium, yet large quantities of ammonia accumulated in the medium from the third to the sixteenth day (Fig. 1). Where dextrose was present, the ammonia accumulated in very small quantities, while the weight of the mycelium increased considerably till about the seventh day, when probably autolysis set in and the weight of the fungal matter began to decrease gradually.

Due to the heavy accumulation of ammonia in the medium lacking dextrose the reaction of the medium became more and more alkaline till at the end of the sixteenth day the pH was 7·6, the initial pH being 6·5. While in the medium containing dextrose the pH at the end of the sixteenth day fell to 5·1 possibly due to an increased production of organic acids.

It was found that greater amounts of amino-nitrogen were utilised by cultures to which dextrose was added, as manifested by the smaller amount of amino-nitrogen. The accumulation of ammonia however in such cultures is far less than what obtains in the sugar-free medium, since the nitrogen is synthesised into fungal protein (Fig. 1).

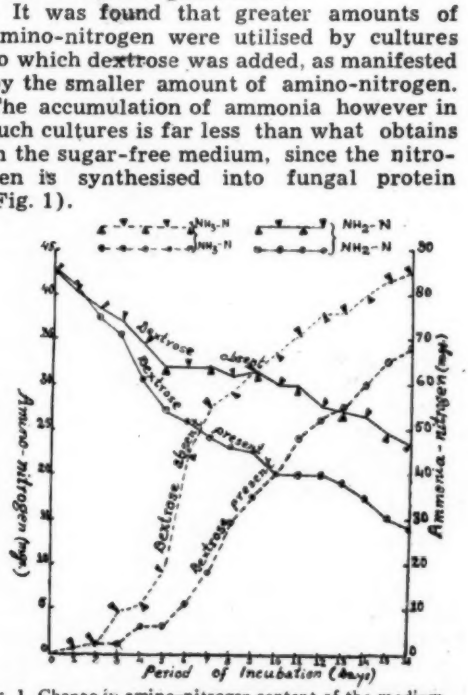

FIG. 1. Change in amino-nitrogen content of the medium and ammonia accumulation by *Penicillium notatum* during the period of incubation.

Thus the presence of available carbohydrates will be of ultimate benefit to the crops provided:

1. The amount of available carbohydrates is not very large, otherwise the micro-organisms will merely live on that source of energy, breaking up only as much of the

organic matter in the soil as is needed for the nitrogen metabolism. The higher plants would in that case only lose on account of the addition of carbohydrates since the micro-organisms would complete with them for the available plant food in the soil and would become injurious instead of being beneficial.

2. The soil is free from parasitic fungi. On addition of carbohydrates the parasitic fungi if present in the soil will only increase in numbers; this will be detrimental to the higher plants. This fact does not appear to have been fully appreciated by the previous workers.

Grateful thanks are due to Dr. R. K. Saksena for suggesting the problem and for his kind encouragement.

Botany Department, B. S. MEHROTRA.
University of Allahabad,
Allahabad,
May 18, 1949.

1. *J. Biol. Chem.*, 1921, **45**, 365. 2. *Jour. Indian Inst. Sci., Bangalore*, 1928, **11**(A), 141. 3. *J. Biol. Chem.*, 1913, **16**, 121. 4. *Jour. Amer. Chem. Soc.*, 1917, **39**, 1503.

THE MEGASTROBILUS OF *NIPANIORUHA GRANTHIA* RAO, A. R.

A RECENTLY examined section of a silicified block from Nipania, Rajmahal Hills, Bihar (Jurassic), shows a petrified conifer megastrobilus measuring 1·6 cm. by ·5 cm. The strobilus has been slightly distorted during fossilization. The only longitudinal section available of this strobilus (see Photo. 1) shows nearly 35 inverted seed-bearing scales arranged spirally and fairly compactly along an elongated axis. The ovules are dorso-ventral in form, approximately 1 mm. by ¾ mm. along their broadest plane, have curved micropyles and are sunk in seemingly fleshy scales. Whether these scales are single or double in nature is not clear. The ovules are cut in different planes, mostly longitudinal or oblique. Some are cut lengthwise along their dorso-ventral plane (*a*); others are cut longitudinally but perpendicular to the dorsoventral plane (*b*), and some others transversely (*c*). A few ovules are cut obliquely near their micropylar part showing its curvature (*d*) and one ovule shows its micropylar part in an obliquely longitudinal section (*e*). In one of the ovules (*f*), the section has passed more or less transversely across the micropylar apex showing the slit-like micropyle. Two-winged pollen

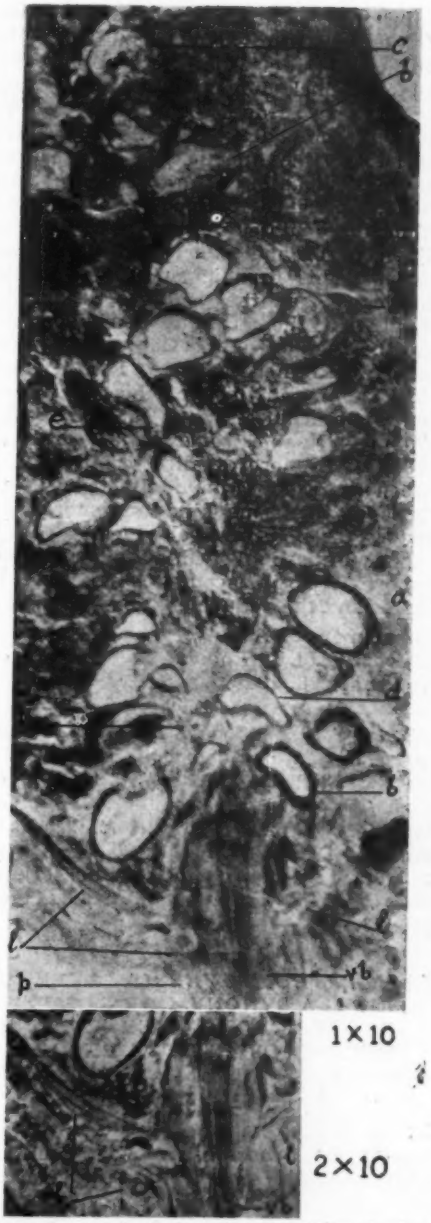

PHOTO. 1.—Longitudinal section of strobilus showing seeds cut, along their broadest plane (*a*), vertically at right angles to this plane (*b*), transversely (*c*), obliquely along the micropyar part showing the micropylar curvature (*d*), obliquely longitudinally along the micropyle (*e*), and across the micropyle (*f*); *l*, leaves; *p*, peduncle; *sc*, scale; *vb*, vascular supply of the cone.

PHOTO. 2.—A darker print of the basal part of the peduncle showing the attachement of the leaves.

grains are seen at the nucellar tips of some of the seeds. The chief importance however, of this interesting section is, that on the fairly thick and possibly fleshy peduncle, are borne two leaves (*l*) (see Photos. 1 & 2), one on each side. These leaves are remarkably like the needle-like decurrent leaves of *Nipanioruha granthia* Rao, A. R. 1946), a petrified conifer shoot with intercalary tuberculate swellings, described from Nipania itself and referred to the Podocarpaceæ. This organic connection between the leaves and the peduncle, leaves little doubt that the strobilus being described, was the female fructification of *N. granthia* Rao, A. R. There are also certain resemblances between this strobilus and a petrified Podocarpinean cone described from Nipania—*Nipaniostrobus Sahnii* Rao, A. R. (1943). A more detailed comparison between the two will have to wait until more cones of the same kind and more satisfactory sections are obtained. The full paper will be published elsewhere, but the important organic connection between the leaves and the peduncle is recorded here.

Department of Botany, A. R. RAO.
University of Lucknow,
November 28, 1949.

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SAGITTA BOMBAYENSIS, LELE AND GAE—A SYNONYM OF *SAGITTA ROBUSTA* DONCASTER—WITH A RECORD OF *SAGITTA PULCHRA* DONCASTER, FROM INDIAN COASTAL WATERS*

IN the course of a detailed study of chætognaths of the coastal waters of the different parts of India, some errors in the account of 'The common Sagittæ of the Bombay Harbour' by Lele and Gae (1936) have come to light. Russell (1936) and Kemp (1938) have pointed out the importance of *Sagitta* as an indicator of water movements which have in turn a bearing on fishery problems and the need for proper classification.

The form assigned by Lele and Gae to *Sagitta bombayensis* agrees in all systematic details with the widely distributed species—*Sagitta robusta* Doncaster. Sketches and tables by Burfield and Harvey (1926) show that *S. robusta* presents variations within the specific limit and that *S. ferox* Doncaster is a synonym of *S. robusta*. The following table will show that *S. bombayensis* agrees, practically in all characters, with *S. robusta*. The description of the latter is based on the details given by Doncaster (1902), Burfield and Harvey (1926), John (1933) and also on Michael's description of *S. ferox* (1919).

S. bombayensis, Lele and Gae	*S. robusta* Doncaster
Head is broad and short	Head broad and thick. The shape of the head varies according to the condition of prehensible spines
Collarette thick up to ventral ganglion	Collarette well developed extending to ventral ganglion and in some cases to anterior fin
Body opaque and bodywall muscular	Body firm and opaque, musculature strong
A thickened epidermis extends nearly all through the length of the body	Epidermis is thickened behind the head
The posterior fin is equally short as the anterior fin	The anterior fin may be as long as or longer than posterior, but generally slightly shorter
Posterior fin widest in the middle of its caudal half	Posterior fin widest behind the septum
Tail is ⅓ the body in length	Tail is 25 to 32 per cent. of the body
Distance between genital openings is about 12 per cent. in large specimens	Distance between genital opening is 13 per cent (smaller specimens)
Anterior fin and posterior fin separated by ⅓ the length of the fins	Length of the posterior fin 18 to 20 per cent. of the body. Anterior fin to posterior fin is 7·8 per cent. of the body. Hence distance between the fin is ⅓ nearly
Prehensile jaws 9–10	Prehensile jaws 5–8
Anterior teeth 4–10	Anterior teeth 6–8
Posterior teeth 8–26	Posterior teeth 11–16

While describing species of *Sagitta*, it is customary to record the measurements of the collarette, ventral ganglion, anterior and posterior fins, distance between the fins, tail septum and seminal vesicles of a large number of specimens, as has been done by Michael (1919), Burfield and Harvey (1926), John (1933) and Subramaniam (1940). Lele and Gae do not observe this convention,

but base their description on three specimens, two of which are immature, although their species is stated to occur in swarms during the monsoon period. In instituting this species, they rely on only two characters—the number of prehensile jaws and teeth and the thick epidermis, while according to John (1933), the jaws and teeth fall off at times, while the thickened epidermis occurs also in *S. pulchra*, *S. ferox* and *S. regularis* (*vide* Doncaster, 1902).

S. robusta has been recorded from Madras (John, 1933) and the Gulf of Manaar (Varadarajan and Chacko, 1942). It has been described as a common species of *Sagitta* of the Indian Ocean by Doncaster (1902), Fowler (1906) and Burfield and Harvey (1926). Comparison of the specimens from both the coasts of India with Lele and Gae's species from Bombay, makes it evident that the latter is a synonym of *S. robusta* Doncaster as is *S. gardineri* Doncaster a synonym of *S. enflata* Grassi (*vide* Burfield and Harvey, 1926) recorded by John (1933) and Menon (1945) from the east and west coasts of India respectively.

A study of the plankton collections from Bombay enables me to record *S. neglecta* Aida, *S. tenuis* Conant and *S. pulchra* Doncaster, of which the last named is the first record from Indian Coastal waters.

Grateful thanks are due to Dr. H. Srinivasa Rao and to Dr. B. S. Bhimachar for helpful criticism, and to Dr. D. V. Bal, for the loan of the plankton samples.

Central Marine Fisheries
Research Station, P. C. GEORGE.
Calicut,
October 24, 1949.

* Published with the permission of the Chief Research Officer, Central Marine Fisheries Research Station, Mandapam.

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THE LATICIFEROUS SYSTEM OF *REGNELLIDIUM DIPHYLLUM* LIND.

THE latex was observed in the living plants of this rare member of the Marsiliaceæ grown from spores obtained by the late Professor Sahni from Brazil and successfully germinated at Almora and Lucknow. In Bombay the plants were grown on the fringe of shallow ponds holding temporary waters, in deep water reservoir, on moist soil, in muddy places, on dry soil watered daily, etc. The latex was more readily observed in plants growing terrestrially than in plants growing aquatically. This was rather unexpected, as in ferns the latex has not been known to occur. Possibly the earlier workers[1] on the plant using the preserved material took latex secreting cells for tannin sacs in the permanent preparations; or the material may have come from plants growing aquatically in which the latex dissolves slightly and turns acrid as in the Musaceæ.

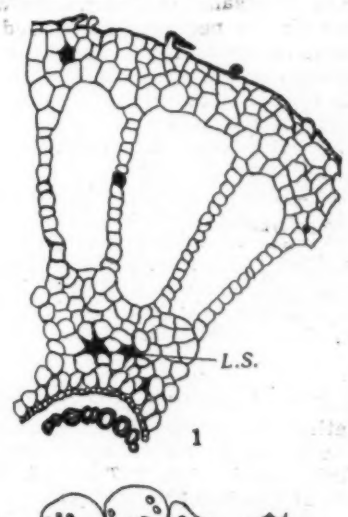

FIG. 1–3. *Regnellidium diphllum* Lind.
FIG. 1. T. S. of petiole showing laticiferous sacs × 40.
FIG. 2. A part of the inner cortex of stem showing latex sacs × 135.
FIG. 3. Latex filling the cavitiest of the stellate parenchyma of the aerial diaphragm × 135. L. S, Latex sacs.

In ferns the cells secreting tannins or phlœba-tannins are easily detected by iron

salts. In the genus *Marsilea* also the tannin secreting cells occur in the cortex of the stem and petiole,[2] but in the genus *Regnellidium* their place is taken by the cells secreting latex. This latex easily coagulates with KOH, dilute acetic acid, sulphuric acid, alcohol, etc., and gives the usual microchemical tests for latex. On breaking stem or petiole of a young plant, the latex oozes as a milky droplet which turns brown later. The latex does not contain starch grains as in some Euphorbiaceæ.

A preliminary examination of the laticiferous system in this plant showed that it mainly occurs in the inner cortical parenchymatous cells of the stem and petiole, in the phloem region, and in the subepidermal cells therein. It circulates through a channel and accumulates in the cavities of the air spaces above the stellate parenchyma of the aerial diaphragms in the ventilatory tissue of the stem and petiole.

The presence of latex and laticiferous tissue in *Regnellidium*, apart from being a novelty in ferns, introduces a reliable character for deciding the phylogenetic relationships, as in some families and subfamilies of angiosperms. For example, Jeffrey[3] has shown that of the two sections of the Compositæ, the Tubuliflorae and the Liguliflorae, the latter is considered to be more advanced among other reasons on the basis of the laticiferous tissue which is present in the Liguliflorae but absent in the Tubuliflorae. The intermediate group between the two sections, Cynareae, is transitional and has only vestigial laticiferous tissue. The laticiferous tissue here may also prove helpful in a similar manner in deciding the affinities of the Marsiliaceæ. But a discussion of the full significance of the laticiferous tissue system noticed here will be taken up on the completion of its detailed examination by Mr. M. Durairatnam of this laboratory.

Department of Botany, T. S. MAHABALE.
Royal Institute of Science,
Bombay,
August 15, 1949.

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INDICATORS IN CERIMETRY*

SETOPALIN was recommended by Knop[1] in the titration of iron with potassium permanganate, and Erioglaucin and Eriogreen were both employed by Furman and Wallace[2] in the same reaction, but with ceric sulphate as oxidant. They give greenish yellow solutions in hydrochloric or sulphuric acid upto 3N and transform into orange-red oxidation products on adding a drop of ceric sulphate. The colour change in every case is sharp and reversible. At the equivalence point, the colour change to the oxidised form is temporary, lasting only a few seconds. Addition of an extra drop of the oxidant deepens the colour, and makes it more permanent, without in any way affecting its reversibility. In this case, if 0·05 ml. is subtracted from the total volume of the oxidant, accurate results are obtained.

In all the following titrations the initial volume of the solution is adjusted to about 100 ml. after addition of 10 ml. of conc. hydrochloric or 3·5 ml. of sulphuric acid, thus making it 1,0 to 1,2 N with respect to the acid, and titrated in the cold with 0,05N Ceric sulphate in 1,5 N sulphuric acid. 5 to 6 drops of the indicator solution (0,2 per cent. in water) are added, sometimes at the start, and also towards the end of the reaction. Results reproducible to 0,02 ml. have been obtained in all cases. Some values chosen at random from a series of experiments are shown in the following table. It is believed that these readily obtainable indicators will help to bring Cerimetry into more general use.

	Reaction	Volume of Ceric Sulphate in ml.			
		Required theoretical	Run using		
			Setopalin	Eriogreen	Erioglaucin
1	Ferrous iron ..	19,35	19,35	19,35	19,35
2	Feric reduced with stannous chloride etc.	18 80	18 80	18,82	18,80
3	Potassium ferrocyanide	13,30	13 35	13,30	13,30
4	Hydroquinone	17,50	17,48	17,48	17,50
5	Uranyl, on reduction with Zn and HCl and aeration	25,15	25,20	25,20†	25,15

† The indicator is added towards the end.

Andhra University, M. VENKATARAMANIAH.
Waltair, BH. S. V. RAGHAVA RAO.
November 1, 1949.

* Titrations involving ceric sulphate may be termed cerimetry on the analogy of permanganometry, dichrometry, etc.

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CHEMICAL EXAMINATION OF THE SEEDS OF *LUFFA GRAVEOLENS* ROXB. AND *LUFFA ECHINATA* ROXB.

Luffa greveolens Roxb.[1] known in Hindustani as *Bindal*, belongs to the natural order *Cucurbitaceæ*. It is found in U. P. and Bengal in India, in Abyssinia and in tropical Africa. The fruits are used in chronic bronchitis, in lung complaints and for several other ailments.[2]

Luffa echinata Roxb.[4] also known as *Bindal*, belongs to the same order and is reputed to possess medicinal properties similar to the other.[5]

The seeds from the fruits were extracted with pêtroleum ether (60-80° C.). The extracts, after complete removal of the solvent, gave in each case a fixed oil (yields being respectively 11.6 and 11.14%), which was yellow in thin layers and brownish red in moderate thickness. The oils were examined chemically and gave:

TABLE I

The oils	*Luffa graveolens* Roxb. (A)	*Luffa echinata* Roxb. (B)
Specific gravity ..	0·9594 (37 °C.)	0·9157 (32 °C.)
Refractive index ..	1·4740 (31 °C.)	1·4725 (31 °C.)
Saponification value ..	197·20	143·0
Acetyl value ..	75·06	27·30
Iodine value (Winkler's) ..	96·70	94·52
Acid value ..	47·75	63·96
Reichert Meissel number ..	3·315	1·984
Hehner value ..	92·45	95·45
Unsaponifiable matter ..	0·2905%	2·756%

TABLE II

Constant	A			B		
	Mixed acids	Solid acids	Liquid acids	Mixed acids	Solid acids	Liquid acids
Refractive index at 31° ..	1·4695	1·4780	..	1·4775	..	1·4710
Iodine value ..	107·60	135·40	..	82·12	Zero	107·90
Acid number ..	187·90	187·10	..	187·2	200·2	168·10
Mean molecular weight ..	298·0	299·30	..	299·0	279·7	333·10
Percentage of saturated acids ..		20·78	..	..	..	25·0
Percentage of unsaturated acids ..		79·22	..	..	..	75·0
Titre value	24·25 C.	..	..	23·75 C.	48·0 C.	..

Full details of the complete examination of the oils will be published later.

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K. C. PANDYA.
Chemistry Laboratory,
St. John's College,
Agra, JAGAT NARAYAN TAYAL.
Agra Medical College,
Agra,
October 10, 1949.

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REVIEWS

CRYSTAL GROWTH*

IN times past, well-developed clear crystals were a rare gift of nature and were highly valued. Their lustre and regularity of shape have been a source of pleasure to the layman through the centuries and a cause for speculation to the naturalist and philosopher. In recent years, however, the demand for single crystals has outstripped nature's bounty. The need for large crystals free from flaws for spectroscopy, piezo-electric measurements and the various purposes of the electric industry cannot be met from the diminishing natural sources, nor do those give a sufficient variety. This has led to researches on the methods of accurate control of crystallisation from the vapour phase, the melt, from supersaturated solutions and from hydro-thermal processes under high pressure simulating those in nature. The present brochure is the outcome of a general discussion on the theoretical and experimental aspects of artificial crystal growth held at Bristol in April 1949. Almost all the important workers in this field numbering more than sixty from England, U.S.A., Holland, Germany, Belgium and Switzerland contributed papers and took part in the discussion. The contributions are partly theoretical and partly experimental. The experimental papers fall fairly sharply into two classes—those dealing with rapid growth and those dealing with extremely slow growth.

The volume is divided in the main into four parts with the headings (1) Theory of crystal growth, (2) Nucleation and normal growth, (3) Abnormal and modified crystal growth and (4) Mineral synthesis and technical aspects, each being followed by a general discussion. The first part deals with the theoretical studies of the forms of equilibrium of crystals, surface structures of crystals, influence of dislocations on crystal growth and that of foreign material on habit modification. The principal contributors are, Stranski, Moliere, Burton, Frank and Egli. In Part II, the kinetics of crystallisation which includes two processes, namely the formation of three dimensional nuclei and the growth of these critical nuclei to microscopic dimensions has been discussed by Dunning and others in some detail both from the experimental and theoretical standpoints. The numerous anomalies observed in the process of crystal growth and also the conditions under which crystal growth are modified are discussed in Part III. The last part of the symposium is mainly concerned with many of the recently developed methods for growing CaF_2, LiF quartz and such other crystals of high commercial value. Anybody who is interested in the techniques of growing crystals will find this part and especially the contributions by Stockbarger, Menzies, Holden and Robinson very useful.

R. S. K.

* *Crystal Growth.*—Discussions of the Faraday Society (London), No. 5, 1949. (Gurney & Jackson, 98, Great Russell Street, London.)

Excited States of Nuclei. By S. Devons, *Cambridge Monographs on Physics.* (Cambridge University Press, Bentley House, N. W. 1) 1949. Pp. 152 Price 12/6.

The volume under review conforms to the general plan of the Cambridge Monographs on Physics, and presents the results of most recent research on the excited states of nuclei mainly from the experimental standpoint. The experimental methods of study and the important and typical results obtained therefrom have been described in some detail. No attempt has been made nor is this to be expected in a small brochure of this kind, to give a comprehensive survey of all the experimental data which are accumulating at a very rapid rate. On the theoretical side, only the results of recent theories have been indicated without going into much detail.

The short introduction is followed by four chapters. The first two deal in turn with the excitation of "bound" and "virtual" states of nuclei. The term "bound states" is applied to the case if the only transition possible is by electromagnetic radiation, while the term "virtual states" is applied to the case if the dissociation from nucleus of one or more nucleons is energetically possible. The next chapter deals with the radiative transition between nuclear states, while the last chapter is devoted to the general problem of interpretation of data concerning nuclear spectra.

Specialists working in the field of nuclear physics will find the monograph particularly useful.

R.S.K.

Electricity and Magnetism: Classical and Modern. By G. B. Deodhar and K. S. Singwi. (Students' Friends, Allahabad and Benares), 1949. Price Rs. 15.

The book under review is intended to give "an introductory account of the main topics of electricity and magnetism". It consists of two parts, classical and modern, of which the former deals with electrostatistics, magnetostatistics and electromagnetism and the latter treats with the more recent developments since the discovery of the electron. The book is intended primarily to fulfil the needs of students going for the B.Sc. (Pass and Hons.) examinations and there is no doubt that it would eminently serve this purpose as most topics are dealt with in a manner readily capable of being reproduced in an answer paper. However, it is not certain that a student, reading only this book, can obtain a good understanding of the fundamentals of electricity and magnetism. The book reminds one of lecture notes rather than a text-book, ideas which are developed in later sections being freely used in earlier ones, with no indication to the reader as to where he can find these explained. There are a number of inaccuracies of statement and errors even in mathematics. For instance, one finds in p. 174 "The practical unit of mutual inductance is also *henry*. It can be defined as the e.m.f. in volts when the current is changing at the rate of one ampere per second". Again, on p. 182, the solution of case (2) of the growth of current in a circuit containing inductance, capacity and resistance is wrong and occurs from the fantastic assumption that, when the two roots of the auxiliary equation of a second order differential equation in t are equal ($=a$), then the solution is $e^{at}(A+B)$. Misprints are also many, some of which occurring in the mathematics are likely to lead to confusion.

In spite of the above defects, the experimental portions are well described and the second half of the book, dealing with modern physics, contains a good account of the recent developments. It is to be hoped that these defects will be remedied in a later edition.

G. N. R.

The Adsorption of Gases on Solids. By A. R. Miller. (Cambridge University Press), 1949. Pp. viii + 133. Price 12/6 net.

The phenomenon of adsorption has been engaging the attention of scientific workers for some time from theoretical as well as practical points of view. In the latter category it has found extensive application in a wide variety of fields, such as "outgassing" in the manufacture of discharge tubes and wireless valves, removal of the last traces of gas in the production of perfect vacuum, manufacture of gas masks, ion exchangers in water purification, etc., and the recently developed technique of chromatography. While the technical applications of adsorption processes are impressive and can be compared with those of the closely related phenomenon of catalysis there is still much to be done with regard to the theoretical aspect.

A few years ago all that was known of this phenomenon could be expressed by an empirical equation known as the Freundlich isotherm. A distinction had to be made between the purely surface action and the reaction taking place in the interior of the solid. Adsorption relates to the first, while "absorption" is used to denote the second. McBain (now Director of the National Institute of Chemistry, India) recommended the word "sorption" to cover both. Adsorption again is of two types, one due to physical or van der Waals forces, and the other due to chemical forces. The former is *van der Waals adsorption*, while the latter is known as *activated adsorption* or *chemisorption*.

A clearer understanding of the subject was made possible by the contributions of Langmuir relating to his famous unimolecular theory of film formation, followed by a host of others. At low pressures the phenomenon of adsorption is concerned with the formation of a film only one molecule thick. Multimolecular films are produced near the B. P. of the gas or below the critical temperature. Langmuir derived a general equation from first principles, which reduces to Freundlich isotherm under restricted conditions of temperature and pressure.

Langmuir's experiments showed the importance of keeping the surface clean in all studies of reactions between a solid surface and gas, and many of the discrepancies between experimental and theoretical results could be traced to the impurities which had not been removed. One of the earliest to recognize this fact and to pursue this aspect of the problem was the late J. K. Roberts of Cambridge, who initiated a scheme of research, the results of which were published in 1939 in a monograph entitled "Some Problems in Adsorption". After the death of Roberts the duty of bringing out a second edition was taken up by his collaborator A. R. Miller, according to whom "it was necessary to discard much of the original text

and to rearrange the presentation of the remainder to confom to the new material which was to be introduced".

The word "impurity" occurring in the very first sentence of the book sounds a little odd. This however is a minor criticism. The problem of adsorption is treated systematically first from the point of view of the kinetic theory of gases, followed by the modern statistical theories. Mobile and immobile films are distinguished, the effect of dipole interactions considered, as also the variation of the potential field provided by the adsorbing surface. One of the paragraphs is entitled "The kinetics of adsorption and evaporation in a mobile film on 110 plane of tungsten when each adsorbed particle precludes occupation of neighbouring sites". This should give an idea of the complicated nature of the problem. A sound mathematical equipment on the part of the reader is needed to appreciate the trends of modern research in connection with the phenomenon of adsorption. The book is meant for and strongly recommended to research workers and advanced students of physics and physical chemistry.

M. R. N.

Physical Chemistry. By G. V. Krishnamurti, (Ghantasala Publications, Eluru, Madras), 1949. Pp. 133. Price Rs. 2.

This book or booklet with its pompous title is meant to cater to the needs of Intermediate students, as its ten chapters cover the Intermediate syllabus only. As stated in the Preface "The explanations of important *theoritical* (author's spelling, not printer's devil, as the spelling is repeated in other pages in the text) principles are talked out as the author would to his own students." He has thus forgotten that his lectures are brought to the notice of a very much larger audience of varying degrees of knowledge and critical faculty, where he has no further chance of explaining or correcting his statements. All this implies that extreme care is needed in the publication of a book, especially a text-book. The author's language and style may be judged from a few samples of sentences chosen from different pages: "This book sets out to give an outline of the principles of physical chemistry in a clear and simple manner as to help the reader obtain an understanding of the essential concepts and ideas on the subject" (Preface). "We do not find atoms flying about singly in oxygen but the element oxygen is made up of molecules each of which is a pair of oxygen atoms" (p. 8). "The hydrogen atom was chosen as the standard of comparison so that its weight was taken precisely as unity" (p. 9). "Gases are sparsely populated with molecules as thinly as Africa or Australia which would therefore admit of large immigration and extensive colonisation" (p. 10). "Of the three states of matter the behaviour of gases is in general much simpler" (p. 24).

As examples of scientific accuracy we have the following:— "These atoms are indivisible, indestructible, and existent from eternity to eternity" (p. 8). "As a few elements like silver do not combine with oxygen or displace it ...." (p. 4). The model answers worked out on p. 77 for calculating the degree of ionisation of NaCl and another substance are wrong; the values 1·92 and 3 represent not ionisation constant but the van't Hoff factor.

In addition there is the exasperating sentence on p. 4: "Refer to Intermediate Experimental Chemistry by the same author....." in the body of the text.

The Indian teacher has an enormous responsibility towards his students and his country. The least that he can do is to inculcate in the young minds the importance of accuracy, accuracy of facts and accuracy of expression. Judged from this standpoint this book falls far short of the ideal and cannot therefore be recommended to students.

M. R. N.

Surface Tension and the Spreading of Liquids. By R. S. Burdon. (Cambridge University Press), 1949. Second Edition. Pp. xiv+92. Price 12/6 net.

This is one of the Cambridge monographs on Physics edited by N. Feather and D. Shoenberg. The major aim of this series will still be (as it was with the Cambridge Physical Tracts out of which this series of monographs has been developed), "the presentation of results of recent research, but individual volumes will be somewhat more substantial and more comprehensive in scope, than were the volumes of the older series. This will be true in many cases of new editions of the Tracts, as these are republished in the expanded series".

The monograph under review seems to be an exception to the above in that "no attempt has been made to do more than extend the tract by including some account of work published in recent years". Any specialist reader would find quite a few fundamental advances missing; the monograph extensively deals with the spreading of liquids but does not make any

reference to the theory of contact angles. Nevertheless, the book is written in a simple and elegant style and presents in an intelligible way many of the recent trends in the field of surface tension and spreading of liquids.

K. S. G. D.

Industrial Hygiene and Toxicology, Volume II. Prepared by a group of specialists under the editorship of Frank A. Patty, Director, Industrial Hygiene, General Motors Corporation, Detroit, Mich. (Interscience Publishers, New York, London), 1949. Pp. 535+1138. Price $ 9·00.

Volume I of this invaluable work on industrial hygiene was reviewed in this journal a few months ago. It was devoted to a detailed survey of the conception of industrial hygiene from ancient time and described in detail the importance of environmental hygiene for the welfare of the workers and its contribution to industrial efficiency.

Toxicology is usually considered a very dry subject, but as dealt with by the eminent authors in Vol. II, it makes fascinating reading. The subject-matter is so beautifully classified and arranged that even lay persons can derive some pleasure in going through it. Immense pain has been taken to describe every kind of chemicals used in industries, small or large. Each individual or group of chemical has received adequate attention according to its importance, *e.g.*, lead, arsenic, mercury, alcohols, aldehydes, various hydrocarbons, etc., have been described exhaustively in relation to their source, use, physiological response and toxic incidence and mode of hazards; others of lesser importance are grouped together and described in detail. The volume can be commended as indispensable not only to those interested in industrial organisation, but even to general medical practitioners, engineers and others associated with industrial establishments. The book is handsomely got up and well printed.

K. P. Menon.

The Sensory Line System and the Canal Bones in the Head of Some Ostariophysi. By Bertil Lckander. (Alb. Bonniers Boktryckeri, Stockholm), 1949. Pp. 131. Price not given.

The author has carefully described the development of the sensory nervous system and the canal bones of a number of species of fishes of the sub-order—*Leuciscus ratilus* L., *Phoxinus phoxinus* L., *Alburnus alburnus* L., *Tinca tinca* L., *Nemachilus barbatula* L., *Siluridæ*, etc., of the cryprinids and cobitids families. The development of the sensory system and the canal bones from the early formation in the embryo has been described in detail. Upti1 now the available information has been based on studies on adult fishes only. In this investigation the author has shown the interrelation of the lamellar and the latro-sensory components of the canal bone and the genesis of the two components. Students of marine zoology will find the monogram very interesting.

K. P. Menon.

Fungi and Plant Disease. By B. B Mundkur. (Macmillan & Co. Ltd., London), 1949. Pp. x+246, 130 figs.

Dr. Mundkur's book, the first to be written by an Indian, is meant to serve as a text-book for students and describes about 48 diseases of Indian crops. A summary of the salient features of the fungi precedes the detailed consideration of the types belonging to the different families. Under each type, the important diseases caused by it are described. The aim is not to be exhaustive, but only to rouse and sustain the interest of the undergraduate; in this, the author must indeed be said to have succeeded.

The first five chapters are devoted to a study of the structure of the fungi, their reproduction and metabolism, symptoms of diseases, and methods of studying them and classification and naming of fungi. The four main classes are reviewed in the next four chapters, and the diseases caused by them described. There is a short chapter on bacterial diseases and another on virus diseases. The last chapter discusses the control of plant diseases. Here the technique for the determination of wheat rust races is included, which might well have found a place in Chapter IV on methods of studying plant diseases. There are literature references to each chapter, but their worth might have been enhanced if cross references had been given in the body of the book. There is a good index.

The book is not without some blemishes. Of the 157 references, there are very few to the work done in Madras and Mysore, more than two-thirds being on work done in America and Europe. The oospores of *Phytophthora arecæ*, *P. colocasiæ* and *P. parasitica* are stated to be amphigynous, when the description should apply to the antheridia. Notwithstanding a few such instances of ambiguous terminology and some misprints, the book will be of real

service to those for whom it is intended. It is to be hoped that necessary corrections will be made and additional chapters written in its second edition.

The book has been well got up, on excellent paper, in bold type and moderately priced. It should find a place on the shelf of every student of mycology in India.

S. V. VENKATARAYAN.

Natural History of Marine Animals. By G. E. MacGinitie and Nettie MacGinitie. (McGraw-Hill Book Company, Inc., New York), 1949, Pp. 473. Price $ 6·00.

All those interested in the natural history of marine animals will welcome the appearance of this book. It has for its subject the behaviour of sea animals in general, and of the Pacific Coast of North America, in particular. The authors have aimed at making the book useful not only to the students and the teachers engaged in a serious study of marine zoology, but also to the "layman uninitiated to the zoological terms". This extremely difficult task of satisfying both these classes of persons has been sought to be achieved firstly by reducing the scientific jargon to the minimum and secondly by giving easy definitions of unavoidable technical terms and Latin words; the result, however, is still a partiality towards student readers and it seems to be ambitious to expect the layman to patiently go through all the meanings and definitions, although, if he does so, he will find the information presented in the book very interesting.

There are 31 chapters in the book followed by a short list of useful publications relating to marine animals and an index. The first hundred pages, divided into twelve chapters, are devoted to a variety of general considerations namely food, comparison between the fauna of land and ocean, groupings of animals, animal relationships, growth rates, burrowing, variation and succession and geological records left by animal activities. One is bound to feel that in this part of the book there is too much of a jump from one subject to another; but probably this could not be avoided as it has not only to give the student an idea of the ocean as an environment for animals but also to provide the first lessons in general zoology to the uninitiated. The remaining part of the book deals with the various groups of animals inhabiting the sea from Protozoa upwards. Under each group is given a brief account of the distinctive characters of the same followed by a simple and interesting discussion of the habitat, feeding, locomotion, reproduction, etc. of the typical forms with special reference to the local marine species. Those animals most frequently met with and those with most interesting habits have been chosen for purposes of discussion. A list of the general habits of phyla and classes has been appended at the end of the text, which is particularly useful to students. The book is well illustrated with a number of good photographs and drawings. The style is in general simple and pleasing, though sometimes a little pedagogic. The get-up and the print are excellent

The keen interest that the authors have in the subject of marine zoology is evidenced by the profuse and lucid references in the book to their personal observations on the habitat and behaviour of many of the marine animals on the west coast of America. In spite of the local nature of some of the forms chosen for detailed reference, the general problems discussed are of such wide importance and interest that the book will be very useful to all students of natural science as well as to the general reader.

B. S. BHIMACHAR.

Principles of Insect Pathology. By Steinhaus. (McGraw Hill Publications in the Agricultural Sciences, 1949). Pp. x+757.

This book—a companion volume to the author's "Insect Microbiology"—deals specifically with the microbial diseases of insects as well as with certain amicrobial diseases, injuries and abnormalities. Intended originally as a text-book for the use of students, specialising in Insect Pathology, this book has, since, proved itself highly valuable to lecturers and research workers in various fields.

The field of Insect Pathology deserves to be more widely known, as it has made vastly significant contributions to general biology, agriculture and medicine. The author's masterly treatment of it deserves high praise by everyone interested in biology and medicine.

Both as regards the study of diseases caused injurious insects affecting crops and man and the biological control of insects by means of such diseases, this book will be of immense value to workers in such important fields as Medical Entomology, Insect Toxicology, Insect Physiology, Insect Ecology, Economic Entomology and Insect Taxonomy.

The subject has been dealt with in fourteen chapters under highly representative and practically useful aspects like Resistance and Immunity—Symptoms and Pathologies—

Bacterial Infections—Fungus Infections—Virus Infections—Protozoan Infections—Nematode Infections and Biological Control. The historical aspect of Insect Pathology has also been briefly narrated. Authors and subjects indices have been appended. Copious references to the various aspects of Insect Pathology are cited. The diagrams, photographs, photomicrographs and electron micrographs—are very well brought out, and highly descriptive and instructive in character.

In the chapter dealing with Applied Insect Pathology and Biological Control, Insect Control through the agency of pathogenic micro-organisms has been thoroughly discussed and it is well shown how the greatest stumbling block is the general ignorance about this specialised subject, and man's poor control over the various environmental factors. Nevertheless, the author recognises that whatever microbial control *does* take place in Nature, is of great economic importance.

The printing and general get-up of the volume are highly satisfactory and leave nothing to be desired.

B. K. M.

Annual Review of Biochemical and Allied Research in India, Vol. 18. (Society of Biological Chemists, India, Bangalore), 1947. Price Rs. 3 or 6 *sh.*

This publication reviews the researches in the field of Biochemistry and their applications to pharmacology and nutrition. Though appearing towards the end of 1949, it is purported to deal with the activities of 1947. Yet, not infrequently, citations to literature published in 1948 have been made; they are mostly confined to the author or to his immediate environs. Giri has, as usual, ably reviewed the work on enzymes under appropriate heads, though in just a 3-page review dealing with 12 references, 6 relate to 1948. Nutrition has been dealt with under 2 sections, general and animal nutrition. The section on General Nutrition reveals a more widespread activity during the year. Considerable attention has been given to the processing of foodstuffs, particularly soya bean, and to methods of conserving the existing stocks of grains. The fact that India loses annually 317,000 tons of rice through infestation and spoilage shows the magnitude of the problem. The various deficiency syndromes investigated during the year have been well summarised and help to give the reader a fairly cogent picture. "The use of hydrogen peroxide as a milk preservative is suggested by Banerji" (p. 14) gives the impression that Banerji is the originator of the method whereas a study of his paper will reveal that Romani worked this method with success in Italy in 1944. The same paper has been reviewed admirably and without ambiguity on p. 61. Despite the expert treatment given to the Section on Animal Nutrition, the feeling is irresistible that much of what is reviewed does not relate to 1947 but to earlier years. Less than one-fourth relates to 1947. The chapter on Vitamins is really refreshing and represents a clear and succinct account of the work in this field without any of the blemishes apparent in the earlier sections. David's review of Pharmacology and Dastur's on Dairy Science are extensive and leaves the impress of a critical study of the work done in the respective fields.

Almost the first reaction on turning the pages of the *Annual Review* is that the output of work during the year 1947 has been very much on the low side, a feeling given vent to by some of the contributors. The Editorial Board could have done better in scrutinising the contributions and avoided such blemishes as citatations to 1948 publications, wrong references (a glaring instance is reference 10 on page 7), summary of work done in 1941, 1942, 1943, etc. and absence of the year in most references to the section on Protein and Fat Metabolism. That some of these lapses are traceable to contributors who happen to be in the Editorial Board is regrettable.

S. RANGANATHAN.

SOUTH AFRICAN FISHERIES*

THE Nineteenth Annual Report of the South African Division of Fisheries issued by Dr. von Bonde, the Director, speaks of the gradual return to activity of the Department after the war. Extensive survey operations are reported on the West Coast between the Dassen Island in the South and the Orange River mouth in the north, bounded shorewards by the 100 fathoms contour, and seawards by the 300 fathoms contour to study and demarcate the profitable trawling grounds for the hake or the Cape stockfish (*Merluccius capensis*). It is of interest to note that there has been further development of the deep-sea fisheries as well as of the inshore fisheries of

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* 1. *Annual Report of the Division of Fisheries, South Africa for 1947.* 2. *Investigational Reports*, Nos. 9, 10 & 11, Fisheries and Marine Biological Survey Division, South Africa. (Govt. Printer, Pretoria), 1949.

S. Africa owing to substantial expansion in the trawling and inshore fishing fleet. According to the report, the pilchard industry (now estimated to be dealing with about 102,500 tons of pilchard per annum) and the soupfin shark industry, which have both rapidly expanded in recent years, have begun to indicate needs for suitable measures of conservation. The laboratory investigations carried out by the Department include hydrological, biochemical and biological studies and some of the results have been published in the Investigational Reports.

Vitamin A content of the liver oils of the stockfish (*Merluccius capensis*), the Cape spiny dogfish (*Squalus acutipinnis*) and the vaalhaai or soupfin shark (*Galeorhinus zyopterus*) are dealt with by J. A. M. Archer in Investigational Reports, Nos. 9 & 10. Report No. 11 is a study of the food of South African fishes by D. H. Davies with notes on the general fauna of the area giving much valuable information on the food habits of the stockfish which is by far the most important commercial species in South Africa.

N. K. P.

OBITUARY

PROF. AUGUST KROGH

THE death of Prof. A. Krogh which occurred in Denmark in September 1949 has removed from the scientific world one of the most outstanding personalities in the field of comparative physiology. Krogh was born in 1874; he graduated in 1899 and soon made his mark as an original investigator by his Doctorate thesis on the skin and lung respiration in the frog, a work which was the forerunner of a series of brilliant studies in animal physiology. In 1916, he became Professor of Zoophysiology at Copenhagen, when funds were placed at his disposal for the establishment of a laboratory for animal physiology. This institution which he founded and is now world famous had Krogh as its chief till last year when he retired from official life, but not from scientific work to which he was devoted till the last days of his life. After retirement, he set up a small laboratory at his home to study problems concerning insect flight.

Among his numerous scientific achievements may be mentioned the elucidation of the role of capillaries in circulation, more especially the relation of muscular work to the filling of the capillary vessels. This piece of research formed the basis for the award of the Nobel Prize for Physiology and Medicine in 1920. Problems of marine biology, and of respiration and osmoregulation in animals received his active attention wherein his demonstration that active uptake of ions from the surroundings plays a most important part in the salt regulation of the body fluids of animals deserves special mention. Apart from a large series of original papers, Krogh published important reviews from time to time; his books "Respiratory Exchange of Animals and Man" (1916), "Anatomy and Physiology of Capillaries" (1921&1929), "Osmotic Regulation in Aquatic Animals" (1939) and "Comparative Physiology of Respiratory Mechanisms" (1941) will continue to inspire and influence physiolological work for several years to come. Krogh was honoured by many countries and was connected with various scientific bodies including the Indian Academy of Sciences of which he was an Honorary Fellow.

All those who have had the pleasure of knowing Krogh will remember his kindliness and thoroughly international outlook which made his leadership of zoophysiological work at Copenhagen so very successful and they will realize in his death the loss of a most valued and active figure in scientific work and understanding, transcending all national barriers.

N. K. PANIKKAR.

SCIENCE NOTES AND NEWS

The Indian Academy of Sciences

The 15th annual meeting of the Indian Academy of Sciences will be held at the Royal Institute of Science, Bombay, from 29th to 31st December 1949. Professor Sir C. V. Raman will deliver the presidential address, while among the distinguished foreign sicentists taking part in sectional meetings may be mentioned: Professors J. D. Bernal (England), O. E. H. Rydbeck (Sweden), Madame Joliot-Curie (France), Jean Frederic Joliot-Curie (France), A. H. Compton (U.S.A.), Hermann Mark (U.S.A.). There will be a public lecture by Sir C. V. Raman on the "Luminescence of Solids" as well as another one by Sir Robert Robinson later. Excursions have also been arrranged for the participants.

The Indian Mathematical Society

The 16th Conference of the Indian Mathematical Society will be held at the Senate House, Chepauk, Madras, from the 26th to 29th December 1949, on the invitation of the University of Madras. This Society founded in 1907 is one of the oldest Mathematical institutions of the world and has been conducting biennial conferences at different centres of India. Madras has been chosen as the venue for the Conference this year after a lapse of over thirty years.

This Conference will be inaugurated by Sir C. V. Raman on Monday, the 26th December 1949, at 10-30 a.m. Among the delegates attending the Conference are Prof. M. H. Stone, former President of the American Mathematical Society, and Prof. Herman Wold, prominent statistician from Sweden. An exhibition of mathematical and scientific interest will be held at the Senate House during the first three days of the Conference.

The programme for the Session includes interesting symposia on "The Time-Series Analysis," "Fluid Dynamics", and "The Teaching of Mathematics". Popular lectures and film shows on topics of scientific interest are also arranged during the days of the Conference.

Bose Research Institute 32nd Anniversary

The 32nd Anniversary Meeting of the Bose Institute was celebrated on 30th November, 1949, when Dr. K. C. Mehta, Principal and Professor of Botany, Agra College, delivered the Eleventh Bose Memorial Lecture on "Control of Rust Epidemics of Wheat in India—a National Emergency", illustrated by lantern slides and maps. In the course of his lecture, Prof. Mehta observed that the best method of controlling rust in the long run is to cultivate resistant varieties.

In reviewing the research work of the Institute, the Director, Dr. D. M. Bose, mentioned that special importance is being given to the training of research workers in modern technical methods, like the use of high frequency techniques of powerful source of ultrasonic vibration, paper chromatography and radioactive tracers.

London's 1951 Exhibition

A tower from which radio messages can be sent to the moon will be a novel feature of the 1951 Exhibition to be staged on the banks of the Thames as the centre-piece of the Festival of Britain. It will embody a huge radar telescope with a revolving parabola which will gather in sounds from the sun, stars and meteors.

The largest dome in the world is also being built in Britain for the Exhibition. Made in aluminium, it will measure 365 feet across and 97 feet high and will form the central feature of the Exhibition.

The new dome, which will be built without any interior supports, will be named the "Dome of Discovery".

Another innovation will be a telecinema designed on entirely new principles and staging both film and television programmes. The audience will be placed both above and below the projection beam because television waves must travel horizontally.

Prof. Dr. Edward Condon

Dr. Edward Condon, Director of the United States National Bureau of Standards, is expected to arrive in this country by the end of this month, at the invitation of the Government of

India. He is attending the Indian Science Congress in Poona and thereafter will tour the country, visiting some of the research laboratories. It is learnt that he may be invited to accept the Directorship of the Indian Institute of Science, which has been vacant for some time.

Rajasthan Academy of Sciences

The Rajasthan Academy of Sciences, which was inaugurated in Pilani on 27th November 1949, seeks to uphold the cause and progress of science, both pure and applied, in Rajasthan. It is also proposed to start a Journal for the publication of articles of original research.

At a meeting of the "Foundation Fellows" of the Academy, Shri M. L. Schroff, B.A. Hons. (Cornell), M.S. (M.I.T.), was unanimously elected President of the Academy for 1949-50, Dr. B. N. Mulay, Ph.D. (Bombay) Vice-President, and Shri K. R. Ramachandran, M.Sc. (Wales), of the Department of Botany, Birla College, Pilani, Secretary.

Expert Committee's Recommendation on Medicinal Plants

At a recent meeting of the Medicinal Plants Committee of the Indian Council of Agricultural Research, the cultivation of 50 important plants has been recommended on an experimental basis in different climatic regions of India. Six regions have been selected and in each, one centre in the plains and another on a higher altitude are proposed. The centres suggested are: the Simla Hills in Himachal Pradesh, Gurdaspur and Manali in East Punjab, Coimbatore and Nilgiris in Madras, Poona and Panchgani in Bombay, Darjleeng in Bengal and Johrat and Shillong in Assam.

Another recommendation made by the Committee is to test samples of indigenous drugs to ensure that the manufactured goods maintain a high standard of qualtiy. Apart from being used internally in the country, some of these drugs are also exported. It has been suggested that certificates on behalf of the Export Control Organisation of the Commerce Ministry should be issued testifying to the quality of the stuff manufactured.

Specific for Black-Water Fever

The discovery of a medicinal plant, which is a reputed specific for black-water fever, in the Rampa Agency tracts of the Madras Province was one of the important results of botanical investigations undertaken by the Botanical Survey of India, according to its annual report for the year 1947-48, just published. The plant, scientifically called, *Vitex peduncularis* var. *Roxburghiana*, was formerly known to exist only in Assam. Examination of other collections brought from the Rampa Agency has also revealed the existence of a number of plants, originally growing in distant regions like the Himalayas, Assam, Burma and the Andaman Islands.

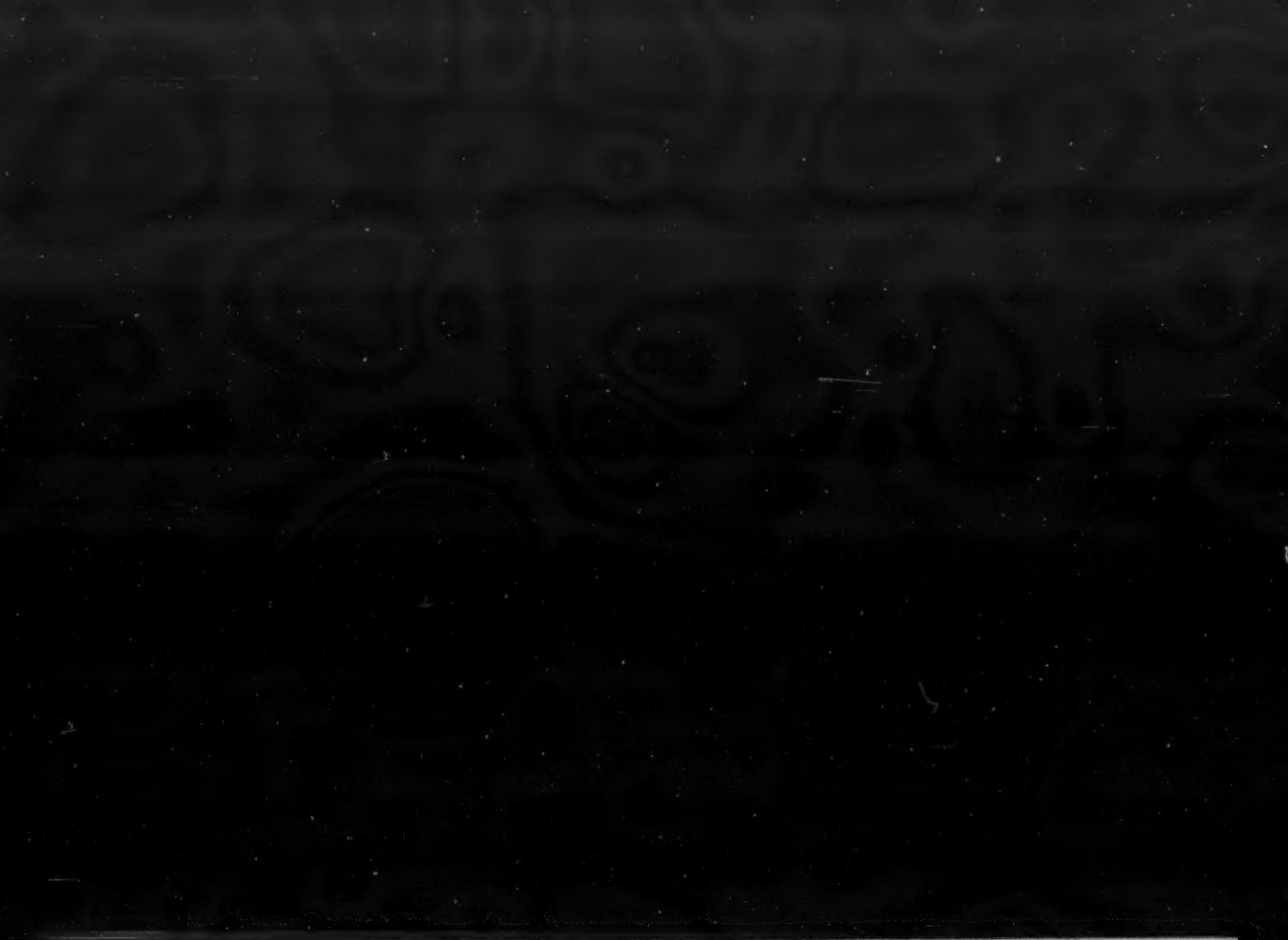
Central Advisory Board on Forest Utilisation

The Central Advisory Board on Forest Utilisation as reconstituted by the Government of India will consist of:—

Chairman: The Hon'ble Minister for Agriculture, Government of India;

Members: Secretary (or Joint Secretary) to the Government of India, Ministry of Agriculture; Inspector-General of Forests; The President, Forest Research Institute; The Director of Research, Forest Research Institute; one representative each of the Associated Chambers of Commerce and Industry, and the Federation of Indian Chambers of Commerce and Industry; two representatives of forest products industries, nominated by the Central Minister of Agriculture; (of these, one should represent the plywood industry); one representative of the Ministry of Industry and supply; the Director, Scientific and Industrial Research; One representative each of the Defence Ministry, the Indian Council of Agricultural Research and the Inter-University Board; two Chief Conservators of Forests from the Provinces (by alphabetical lorder of rotation); and two representatives of consumers nominated by the Central Government.

Secretary (Ex-Officio): Publicity and Liaison Officer of the Forest Research Institute.

The functions of the Board will be: (i) to adivse on the assignment of priority to various items of research conducted at the Institute; (ii) to co-ordinate research with the needs of industry, agriculture and the general public; and (iii) to link research with the needs of the producer and the consumer.

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